THE IRON TRADE REVIEW

VOLUME XXII. CLEVELAND, O., NOVEMBER 7. 1889. NUMBER 45.

THE IRON TRADE REVIEW.

A JOURNAL OF THE
IRON AND STEEL INDUSTRY, THE MACHINERY TRADE AND KINDRED INTERESTS,
IS PUBLISHED EVERY THURSDAY BY THE

CLEVELAND PRINTING AND PUBLISHING CO.,

Corner St. Clair and Wood Streets, Cleveland, O.

TERMS, (strictly in advance):

One year	$3 00
Six months	1 50
Three months	75

Advertising Rates Furnished on Application.

ENTERED AT THE POSTOFFICE AT CLEVELAND, O., AS SECOND CLASS MATTER.

CLEVELAND, O., NOVEMBER 7, 1889.

THE WEEK IN IRON CIRCLES.

General Features.

From now on until February may reasonably be expected the usual lull which characterizes the cast iron pipe, wrought iron pipe, cut and wire nail, barb-wire and structural iron trades. Conversely, the great railroad corporations will come into the market with orders for their renewals. Just how far the present boom will extend is hard to predict, but one thing is certain: it is here, and those "in the swim" are making the best of it At leading centers the feeling is still one of confidence, as will appear from our reports below. Nearly all large consumers of pig iron in the territory tributary to St. Louis are supplied for the remainder of this year, and as the furnaces are not disposed to contract beyond January 1st, it naturally follows that business is comparatively quiet. The feeling is very strong that prices will go higher and a lively demand is expected during the next thirty days. The Chicago pig iron market continues active. It is doubtful if there ever existed at one time a more even or widely distributed demand for foundry iron throughout the Northwest. Every thousand cars calls for from 6,000 to 10,000 tons of iron in various forms and increases demand proportionately. Softeners are in active request, but mostly in small lots. Southern irons are coming in more freely. At Cincinnati the volume of business has been large and taking the whole market together prices are firm. If there is any change it is in the direction of an advance. As to the future, great diversity of views exist. The hopeful feeling, however, predominates, and every indication points to continued expansion in every branch of the iron trade, at least for several months to come. The principal sales, at Louisville, made during the past week were such odd lots of moderate-sized quantities that the furnaces had on hand, principally off grades for prompt shipment. One round sale is reported at a price that covered the advance in freights, which took effect on the 6th inst. There are reported offers on grey forge equal to $15.25 cash at Louisville. W. F. Jarvis & Co. report from Detroit: "Although the sentiments respecting the pig iron market are practically the same as a week ago, the undercurrent shows a still stronger market. The difficulty that brokers and buyers experience in endeavoring to get prices named by the different furnaces, and to get deliveries as wanted, is very noticeable. At the same time, with all the strength, there are some weak spots from time to time, and offers on what might be termed job lots of metal are more frequent now than they were ten days ago. The figures, however, have not shown any decline, except a fraction here and there. Lake Superior charcoal has probably shown more advance during the past week, and developed more strength than any other iron on the list, proportionately, and it surely is about time that this iron should reach its proper relative position. A number of large transactions for charcoal iron for Bessemer steel purposes has occasioned a falling off in the visible supply, and this unlooked-for buying will help matters along considerably for this grade of metal. Sellers usually absolutely decline to make prices for future delivery. For present delivery full figures are demanded and obtained. Southern iron has cut a very small figure in this market in the past week. Some Northern grades of forge iron have been obtained, and also one or two good sized lots of Jackson county silvery at the advanced prices noted a week ago have been purchased. It is expected that some furnaces in the South will very soon commence sales of iron for delivery next year, which will tend to prevent further immediate advances in the market to a certain extent. But with everything upon a firm, and perhaps a high basis, not only in the pig iron market, but in nearly every branch of mercantile business also, and with manufactories running day and night to complete orders, it is thought that no reaction will occur in the near future." Sales at Buffalo have been numerous and varying from 75 to 400 tons, according to wants of consumers. All sales are for this year's deliveries, and in every case are for actual use as fast as delivered. The English markets maintain the utmost activity. Our Manchester correspondents, Messrs. S. W. Royse & Co., write, under date of October 26: "This month has seen a very extraordinary series of advances in prices of pig iron. At Glasgow the advance during the month is about 5s. 6d. per ton, and at Middlesbrough about 7s. 6d. The strong demand continues, and much higher figures appear likely to rule shortly." The steel rail business still shows heavy transactions. The shipments of rails up to October 1 were 919,874 gross tons, not including shipments made by the Allegheny Bessemer Steel Co. Other large orders are pending.

Iron Ore.

The ore shippers have "seen" the vessel men's bluff, and have gone them several better, with the result of cutting the inflated lake freights wide open. The vessel owners, speculating upon the demands of the grain trade and upon the necessities of the ore interests, kept on screwing up prices until business had to come to a stop, and then, when their business was gone, they consented to come down. In many instances they are too late, the ore men having determined to shut down for the season, but wherever ore is yet to come down, any quantity of boats are offering at $1.15 from Escanaba and $1.25 from Marquette, nothing more being expected from Ashland and Five Harbors. Quite a good many vessel owners, satisfied with their season's trade, withdrew on November 1, and obtained a fifteen per cent. drawback on the insurance premium for the season. There is quite a large demand for all grades of ore for immediate delivery, indicating continued activity on the part of kindred interests. One remarkable feature of the market is found in the unusual activity in legitimate mining investments on the part of conservative ore men, who are acquiring new properties and increasing their investments in the Lake Superior country.

Pig Iron.

The market is quiet, but exceedingly firm, with an undercurrent of renewed activity running through it. Hitherto the December season has usually been among the quiet months, but the indications point to the coming December as a month that will witness a great many sales of importance. By that time the consumers will, in a large measure, have exhausted their material, and since the furnace-men have held back with sales for '90 delivery, the chances are favorable to a thriving Christmas trade. Pig stocks continue to dwindle and stand a good chance of being wiped out altogether. Coke has gone up and now sells at $1.75. Bessemer is worth $20 50 cash at Valley furnaces, while a strong all lake ore, No. 1 foundry, is worth $18.

Merchant Iron.

Bar iron continues to sell at $1.75 in car lots at the mill, while sheets are sold for whatever the holder asks. The market is strong and inquiry good.

Scrap Iron.

Old American rails are quoted at $26.50, but none are offering at that figure. No. 1 railway scrap brings $21, car wheels being offered at $17.50.

Hardware.

The trade is excellent in every department, manufacturers' hardware being in particularly strong demand. Metals are firm, with a tendency to advance.

NOTABLE LOSSES TO THE IRON TRADE.

The past fortnight has been prolific of deaths among leading iron manufacturers. The most notable loss is, perhaps, the demise of Clement B. Grubb, at Lancaster, Pa., October 31, aged 74 years. Mr. Grubb was at one time the largest iron maker in Pennsylvania. He was the great-grandson of the discoverer of the great Cornwall iron hills, of Pennsylvania, which for over one hundred and forty years have furnished iron ore for smelting, and whose aggregate output to date is over 8,500,000 tons. Another veteran in the iron business of Pennsylvania to go was Christopher Geiger, who died at Lancaster October 28, aged 81 years. At various times he was proprietor of furnaces in Lancaster and York counties and in Maryland. Still another instance of longevity in the trade was that of Henry Wintnor, of Philadelphia, who attained the age of 86 years, dying of paralysis October 21. He was largely interested in the Logan Iron and Steel Company, the Crane Iron Company, and various other enterprises. A prominent iron manufacturer, whose departure will be severely felt by the American Iron and Steel Association, of which he was one of the executive officers, was Mr. Joel Barlow Moorhead, President of the Merion Iron Company, who died at Philadelphia October 25, at the age of 77 years. He was for several years a railroad and canal builder, and at the time of his death was the largest holder of the stock of the Monongahela Navigation Company, of Pittsburgh. He was in the iron business continuously from 1857 to the time of his death. Oliver Garrison, one of the foremost citizens of St. Louis, died October 28. He went to St. Louis in 1835 and engaged in the steamboat manufacturing and foundry business. In 1870 he organized the Jupiter Furnace Company, in which he was heavily interested. His age at death was 79 years. The death of Francis M. Roots, October 25, at Connersville, Ind., removed from active life a well-known manufacturer. He was the inventor of the famous Root Rotary Blower and President of the company that manufactured it. He, too, reached a good old age: 65 years.

It will be observed that the average age of the six persons above referred to is 77 years—surely a tribute to the healthfulness of the iron business and the correct habits of those who engage in it.

PROTECTION IN TWO BRITISH COLONIES.

Our Free Trade friend, the *Australasian Trade Review*, has no patience left for the protection policy of the new government of Australia. In a recent issue it breaks forth in this wild lament: "It is difficult at present to tell to what length the folly of protection will go in this colony. There is no principle discernible in the attitude either of the Ministry or the Parliament; the manipulation of the duties is simply in the hands of detached interests. To pass an additional duty, the public is fooled to the top of its bent. If it is a question of putting a duty on portable engines, a Minister, (who, it can only be charitably concluded, does not know what he talks about) stands up and assures the country that Melbourne is to be a second Birmingham, the colony of Victoria, be it remembered, not producing any of the great industrial metals."

The ideal condition of things, in the opinion of the *Review*, would evidently be a colony forever dependent upon outside sources for its material supplies, forever a consumer, never a producer. Is it any wonder that, under the previous Free Trade policy, Melbourne has grown to be simply a city of tradesmen? Had any such policy as this prevailed when the struggling states began their industrial existence, we would never have risen above the condition of poor and dependent consumers, always in debt, never able to look out for ourselves. Melbourne has the possibilities of another Birmingham within her, as well as Chicago, or Pittsburgh, or Cleveland, if capital is only encouraged to build up an industrial independence; but she can never attain this position under the dog-in-the-manger policy advocated by our Australian contemporary.

There is another powerful British colony that does not regard this great economic question through the narrow vision of the importer. Canada has established a system of protection to home industries, which she is gradually broadening and strengthening, and, if let alone, she will soon be ready to declare industrial, if not political, independence. Quite as influential a trade paper as the *Australasian Trade Review* (and we yield to no one in our respect for its ability) is the *Canadian Manufacturer*. Answering, in its current issue, some objections of Opposition journals to the tariff policy of the government, it says:

"It is our opinion that the trouble complained of does not lie in the reduction or removal of the tariff generally, but in increasing it. It is not high enough; and for evidence of this we call attention to the Canadian tariff on pig iron, and the American tariff on that article. Our duty upon it is only $4 per ton, and but a very small proportion of that which is required for domestic consumption is made in Canada. To remove that duty would not insure an enlarged production, but would certainly instantly put out of blast the few furnaces we now have in operation. If that duty was largely increased—doubled—the result would be that blast furnaces would be built, the production of which would meet the demands of the country to a very large extent, if not fully. In 1854, when the United States suffered from a purely revenue tariff, the average price of No. 1 anthracite foundry pig iron, at Philadelphia, was $36.75 per ton; but in 1878 the price there under the present protective tariff was but $17.50 per ton. Now, what caused this drop of over fifty per cent.? Protection. It cannot be claimed that the price of Scotch pig has similarly decreased in the same time, for, according to Fossick's History of the British Iron Trade, the price of that article in that country in the first named year, 1854, was 95 shillings sterling per ton, while in the latter year, 1878, the price was 55 shillings. In this latter instance the difference was only $10 per ton, while the difference in the American iron was nearly twice as much. What is said of pig iron will also apply to many other products."

We commend this bold, broad and statesmanlike view to our Australian contemporary and the importing interests which it represents, and we sincerely wish the Australian protectionists success in their efforts to attain industrial supremacy.

IRON MANUFACTURE IN CANADA, ONCE MORE.

More than two years ago, *The Iron Trade Review* spoke at length, from personal observation, of the importance to Canadian iron interests of the Bristol iron district, near Ottawa. It was then carefully estimated that the ore could be mined, calcined and laid down in Cleveland at a cost of $4.25 per ton, including duty. Since then the work of development has gone steadily on, as duly chronicled in these columns, and now the proposition is seriously entertained of smelting the ore at Ottawa, instead of attempting to market it in the United States. Mr. John Birkinbine, in the *Journal* of the United States Association of Charcoal Iron Workers, goes into interesting details concerning the cost of smelting the Bristol ore at Ottawa. The cost of ore laid at Ottawa, Mr. Birkinbine figures as follows:

	Per ton.
Raw ores at the mines	$1.40
Add roasting and loss	.60
Freight to Ottawa	.55
Cost of 1 ton of ore	$2 55

As this roasted ore will yield 60 per cent. of iron or more, the cost of ore for a ton of pig iron will be: 1⅔ tons at $2.55, equals $4.25. The accessibility of fluxing material will make this item small, and an allowance of 50 cents per ton of iron made should be ample. The materials for producing a ton of pig iron he estimates as follows:

Fuel	$6 50	
Ore	4 25	
Flux	.50	
		$11.25
To which may be added for labor, repairs, office expenses, supplies, incidentals, depreciation, etc., say		2.75
Making a ton of pig iron cost		$14.00

This is, of course, theoretical, but it is near enough to awaken general attention, in view of the fact that 50,000 tons of pig iron and 250,000 tons of manufactured, cast and wrought iron enter Canada each year. Upon the question of competition with foreign iron, Mr. Birkinbine figures as follows: The Canadian duty is now $4 per net ton on pig iron—the estimated cost above is per gross ton. In addition the Government offers a bonus of $1 per net ton on all pig iron made in Canada from Canadian ores; therefore, the domestic metal would be protected, at least until the expiration of the bounty period, to the extent of $5 per net ton, or about $5.60 per gross ton. If, now, pig iron made at Ottawa costs $14 per ton, foreign metal would have to be delivered there at $8.40 per ton to meet this cost. But an allowance for profit must be made; including this, as well as the percentage of loss from bad debts, and also adding liberally for possible discrepancies in the estimate—say, $2.60—the domestic product could meet foreign iron delivered at Ottawa at $11 per ton. As the iron is shipped away from Ottawa, freights must be added, but there still seems to be ample margin to encourage the production of domestic pig iron in Canada.

The above estimates are on the basis of using anthracite coal, coke, or a mixture of these two fuels, but the writer believes that charcoal could be used economically. The whole subject is an interesting one, especially in view of the unsuccessful attempts in the past to establish an iron industry in Canada.

A GRACEFUL compliment, as well as a deserved tribute, has been conveyed in the appointment of Mr. Frederick E. Saward, editor of the *Coal Trade Journal*, to represent the coal interests on the New York World's Fair Committee. Congratulations.

THE SAULT ST. MARIE CANAL.

BY R. E. PEARY, C. E. U. S. N.

The St. Mary Canal, which forms the outlet of Lake Superior, is unique in several respects. It is one mile long, has a depth of 16 feet, and has the largest lock in the world, 515 feet x 80 feet x 18 feet lift.

This canal was originally constructed in 1855 with two locks, each 350 feet x 70 feet x 9 feet lift. About 1870 it became evident that the capacity of the canal had been nearly reached, and the work of enlargement was undertaken. This consisted of the construction of the present lock and the deepening of the canal to 16 feet.

These improvements were completed in 1881, at a cost of about $2,500,000, with a most astonishing result upon the traffic of the canal. The number of vessels increased and their size and draught increased to correspond with the larger water-way. The tonnage of the canal increased from 1,500,000 tons in 1881, the first year of the enlarged canal, to 4,5000,000 in 1886, *i. e.* it trebled in five years. In 1888 the tonnage was over 5½ million tons. From 1885 to 1886 to total tonnage increased 37 per cent., and from 1887 to 1888 the average tonnage per vessel increased some 20 per cent. The annual tonnage of the canal is now very nearly as great as that of Suez, 1,685 vessels having passed through the canal in one month. In 1886 it was seen that the capacity of the canal would be reached in two or three years, its ultimate capacity being 96 vessels per day of 24 hours, and 84 having already passed in that time, and a still further enlargement was proposed and is now in progress. This will consist of a lock 800 feet x 100 feet, with a depth of 21 feet on the sills and a lift of 18 feet, and the deepening of the canal to 20 feet.

The new lock is to be placed upon the site of the two old ones, and will be used with the present new one. The cost of the enlargement is estimated at $4,738,865, and the time, five years. If, on its completion, the traffic of the canal takes such a bound upward as after the last enlargement—and there is no reason to doubt that it will—Suez, even with its enlargement completed, will have difficult work to keep pace with it.

The present lock in this canal is undoubtedly the finest, as it is the largest, in the world. It is manipulated entirely by hydraulic power furnished by the fall at the lock, and the operation of hauling in, locking, and hauling out a vessel is easily accomplished in 13 minutes. The cost per ton of passing vessels through the canal was in 1882–83 1½ to 2 cents. It is now about one-half cent.—[U. S. Miller.

FRICTION RELIEVED BY LUBRICATION.

BY PROF. J. F. ELSOM.

Continuing my tests and experiments as begun in a recent issue, I find in a great many instances that oils and lubrication in general do not receive the attention their importance demands, in many instances the price being taken as prima facie evidence of quality. When, as has been shown, the action of oils and all methods of lubrication is merely mechanical, by keeping the surface of the moving body from touching the stationary one, it is plainly a matter of the utmost importance that lubrication, in relation to the efficient working of all kinds of machinery, be more generally recognized and understood. Oil users are as much and no more interested in this matter than oil manufacturers and dealers.

One of the greatest obstacles in practice, I have found in attempting to reduce the practice of lubrication to rule, is trying to adopt some theory that will include and accommodate all the varying circumstances with which oil consumers and manufacturers have to deal; and then to reconcile the diametrically opposed statements and practice of men of equal intelligence and trustworthiness, working to all intents and purposes under precisely similar conditions. In laboratory practice I have often found that a little test, a little inquiry, a little closer inspection, reveal enough difference—perhaps some abnormal condition—want of power, a bad bearing, or worn-out machinery, that may justify or demand some departure from any general rule adopted to govern a comparative standard of excellence assumed by buyer and seller; but besides these explainable instances, there must necessarily occur many in which, with no discoverable variation of condition, the practice of engineers and mechanics is as different as day is from night.

In order to arrive at some standard for discussion, the subject may be naturally and conveniently considered from two standpoints, subdividing each as passing along as the exigencies of the case may demand. These heads are:

1. Lubrication under ordinary atmospheric conditions, which includes the lubrication of all ordinary engines and machinery and shafting; and,
2. Lubrication at high temperature and in contact with steam, which includes the lubrication of steam cylinders and valves, gas engines and carbonic or hot air engines.

We will take, if you please, a sample of the best lubricating oil, the oil that has given the greatest satisfaction to any consumer; place a slide covered with a thin film of it beneath the microscope in an atmosphere of 50°, then place the same slide in a temperature of 200°, and the difference in appearances and size of the oil globules will, indeed, be astonishing. The following sketches from a microscopic test under the varying conditions suggested will illustrate the point.

The slide in moving while hot—200°—does not show the same arrangement of globules, but, though great care was taken, the oil, being thin, moved around in manipulating the instrument. The same slide was used each time, and when the spheres were expanded, as shown, the pellicle was found to be very thin and tense and somewhat easier broken than when cold—a point worth remembering when we estimate the value and efficacy of lubrications.

To a great extent, the same conditions apply to both classes. The conditions of the first class apply equally to the second class, while steam and heat impart some special conditions to the latter. The first element common to the two heads is friction; the primary object of lubrication is nothing more nor less than the reduction and the preservation; hence in order to determine how these two ends may be obtained, we must consider:

1. The nature of friction itself.
2. The principle upon which it may be reduced or overcome.
3. The character and properties of all lubricating substances.

Many writers speak of various kinds of friction, but there are but very few kinds, not more than one or two, but they might say that friction may be recognized under many conditions. Thus, we have the two grand divisions of friction:

1. The friction of quiescence or rest.
2. The friction of motion.

The former being much greater than the latter, as all well know, so, under the second head, we are to recognize what physicists denominate rolling friction, the resistance offered by the circumference of the wheels of a vehicle to the propelling power; sliding friction, the friction of two flat surfaces as an iron planer; revolving friction, the friction of journals and bearings of every description.

Generally speaking, it it with the latter mechanics have the most to deal, and the series of experiments I have inaugurated are for the benefit of this class of artisans; hence the tests I have made, both with oils and iron rollers, in the end, are to determine whether thick or thin oils, pure or compound oils, will give the best results in reducing the friction and heat on machinery. The oils tested will be named in Table 1, opposite which results are found in the column headed "Temperature," and samples of compound oils for heavy and light machinery, some of which were sent by people using them, others were prepared in the laboratory. At the same time, a great number of samples of pure mineral oils, of English and American manufacturers, were tested; these oils were of various gravities and thicknesses. In order to ascertain how they compared with animal and vegetable oils, or with compounds of these with mineral oils, each sample was tested three times, and the instruments used were allowed to cool, and were thoroughly cleaned between each test, so the results cannot be otherwise than accurate.

Table 1, showing relation between bodies of oils at various temperatures and heat—which represents friction in these tests, in fact, the generation of heat is friction—developed under similar conditions on the oil tester:

Material.	Specific gravity at 60° Fahr.	Body at. 60° Fahr.	Body at. 120° Fahr.	Body at. 180° Fahr.	*Temperature.
Water	1,000	.....	.....	.....	.....
Castor oil	060	.....	132	41	158
Resin oil	990	.....	.....	.....	155
Engine tallow	Solid	Solid	41	26	.....
Animal oil	.....	143	37	25	141
Neat's foot oil	.....	112	40	29	.....
Rape oil	916	108	41	30	148
Lard oil	916	96	38	28	146
Olive oil	915	92	37	28	143
Sperm oil	880	47	30	25	133
Mineral oil	905	45	.....	.....	121
Mineral oil, No. 2	875	30	.....	.....	117

The foregoing table exhibits the results obtained by testing a few well-known oils. It will not be necessary to encumber it with the results given by special or compound oils of uncertain, and, most likely, variable composition, besides which, that chief editor of mine frowns ominously when I talk too long. Suffice it to say, thus far the tests and demonstrations entirely corroborate the results already given, confirming the deductions which will be given further on.

Returning to the table, the first column names the oil, the second shows the specific gravity—of which, however, for reasons which will presently appear, no account is made of in fixing the economic value of the oil; while in the third, fourth and fifth columns will be seen the figures, indicating in seconds, the relative body at 60, 120 and 180 degrees temperature Fahr., obtained by noting the time which a given quantity of oil takes to flow through the narrow, contracted orifice of tubes especially designed for the purpose, while in the last column the average normal temperature maintained upon the bearing when it was running at full speed; a three-inch shaft making about 1,500 revolutions per minute, the oil being tested used as a lubricator.

It will be noticed that there is a uniform coincidence between the body or thickness of the oil, and the temperature developed by each, as shown in the respective columns. The only discrepancy apparent being in the base of tallow oil, which, being much thicker than rape, lard or olive oil, at 60 degrees, develops a lower temperature than these; if, however, attention be directed to the respective bodies of these oils at 120 and 180 degrees, it will be found that the seeming paradox disappears, and the irregularity may be explained by the fact that tallow oil frequently contains considerable stearine, a higher temperature may be required to thoroughly liquify it than is required by the other oils.

As it thus appears that the temperature developed by each oil is in proportion or relation to its body, in the same sense that the thicker the oil the higher the temperature, and temperature being an equivalent of friction and an indication of the power necessary to overcome it, it is safe to conclude that the best and most suitable oil for any bearing is the thinnest that will keep the surface apart, and that the extra thickness means a higher temperature and a greater driving power, though, it must be borne in mind that, if the oil be too thin an extra quantity will be required,

(To be continued.)

SERIOUS attention is now being paid in German official circles to a scheme for connecting the Baltic and Berlin by a sea-going ship canal. The question as to whether this could best best be brought about by deepening the Elbe or the Oder, is at present under the consideration of a committee.

* NOTE.—The figures in the last column, headed "temperature," represent the average maximum temperature maintained during three tests of ninety minutes each, of each oil examined, save in the case of the mineral oils, the trials of which had to be stopped in from thirty to sixty minutes, as by that time the oil became exhausted, and there was danger of heating the tester to that point it would ruin it; in fact, I did ruin one tester in attempting to carry these mineral oils too far.

OUR NEW STEEL NAVY.

The report submitted by the Board which conducted the official trials of the new cruiser *Charleston*, on the coast of California, makes a very favorable showing for that vessel. On the four hours' trial run, the average power developed by the engines was 6,666 horse power, the maximum being 6.943 horse-power. The average speed during the whole run was 18 187 knots, and the maximum speed was 18.75 knots. The manœuvring power of the vessel was excellent, as she was rapidly managed and turned quickly. The main exception taken by the Board was to the difficulty experienced and time lost in communicating directions to the people stationed in the steering chamber, where the hydraulic apparatus is situated, and the Board say that some more reliable means of communication is desirable; also some device from changing from one steering apparatus to the other nearer the deck. The conclusions reached are that the vessel's hull, fittings and machinery, including the engines, boilers and appurtenances are strong and well built, and with one or two slight exceptions, in conformance with the contract; the vessel is also, in their opinion, sufficiently strong to carry the equipment, coal, stores, machinery and the armament which has been assigned to her. On this report there is no doubt that the *Charleston* will be accepted from the contractors.

Engineer-in-Chief Melville has been during the month in New York, making arrangements for building the machinery of the two 3,000-ton cruisers in that yard. The hull of one of these vessels is to be built at the New York yard, and that of the other at the Norfolk navy yard, but the machinery for both will be built in the New York yard. Work has already been begun in both yards, laying down the lines for the hulls of these vessels, getting the keel blocks in place, etc., etc., and the material has been advertised for. The preliminary work is to be hurried as much as possible, and probably the keels will be laid down by the end of the year.

The plans for the two 1,000-ton protected gun-boats, authorized by the last naval appropriation bill, are nearly completed and advertisements for bids will shortly be issued. These vessels are known officially as cruisers Nos. 12 and and will be somewhat larger than the *Petrel*, just completed in Baltimore. They will carry batteries of 6-inch rapid-fire guns, and smaller machine guns, will have twin screws with triple-expansion engines capable of working up to about 1,600 horse-power. The speed expected is 15 knots per hour. It is believed that these ships will be exceedingly useful to the navy, and on many stations will answer all the purposes which could be served by a larger and more expensive cruiser. The need of ships of this class has been very much felt. Their cost is limited to $350,000 each.

It is understood that the Commission appointed, some months ago, to select a site for the purposed navy yard on the South Atlantic or Gulf Coast, has not yet reached an agreement, but it is stated that the majority of the Board favor one on the Mississippi River, nearly opposite New Orleans. This site is preferred as being on deep water, with facilities for transportation of material and for obtaining skilled labor; but, at the same time, is in a position easily defended in case of war. The navy yard at present owned by the Government, at Pensacola, is not considered available on account of the unhealthfulness of situation, its liability to epidemics of yellow fever, and the impossibility of obtaining skilled labor there.

An opportunity of comparison between some of our new vessels and those of European navies will be afforded shortly. The *Boston*, *Chicago*, *Atlanta* and *Yorktown* are to proceed to European waters as a "squadron of evolution," under the command of Admiral Walker, late Chief of the Bureau of Construction. These vessels are now fitting out and taking in supplies at the New York navy yard, and as soon as they are ready will start on an extended cruise, during which there will be full opportunity to test their qualities as cruisers and in every way, in fact, except in actual warfare, for which, fortunately, there is no opportunity offered at present.

The gun-boat *Petrel* has been formally accepted by the Navy Department, and has been delivered to the Government at the Norfolk navy yard.

Owing to some defects in the indicators used at the first trial of the *Baltimore*, the horse-power developed by her engines was somewhat less than at first supposed, although the high speed made would have hardly indicated this result. The Department, however, has given permission for an additional trial to determine this point.

The test of the guns of the new dynamite cruiser *Vesuvius* was made October 9, the point to be determined being principally the rapidity of fire of the guns with which she is armed. As speed, and not accuracy, was the important point, blank shells or dummies were used. The first trial was made for distance, shots being fired from each of three guns, which landed respectively, 960 feet, 1,050 feet and 300 feet beyond the mile limit. Then followed the test for speed. The contract demanded a rate of fire of 15 shots in 30 minutes, and this was successfully passed. The three air reservoirs were charged to 2,000 lbs. at the commencement, and five shots were fired from each gun. The following table shows the result:

Guns.	Time for Firing. M.	S.	Air Loss. Lbs.	Initial Pressure. Lbs.
Port	0	53	70	750
Port	1	45	74	750
Port	2	37	74	750
Port	4	15	76	750
Port	5	11	78	750
Center	6	06	105	750
Center	7	04	109	750
Center	7	55	114	750
Center	9	00	104	750
Center	9	58	96	750
Starboard	11	13	118	750
Starboard	13	03	112	750
Starboard	14	37	105	750
Starboard	15	45	120	750
Starboard	16	50	118	750

Projectile—Full caliber (15 in.) weight averaging 527 lbs.

The *Vesuvious* has now passed successfully the test for speed and for rate of fire, and the guns have also passed the test required for accuracy of aim and for range. She will probably be accepted and put in commission at an early date.

INCREASING THE OUTPUT OF CHARCOAL IRON.

Mr. J. C. Holt, Secretary and Treasurer of the Antrim Iron Co., of Grand Rapids, Mich., writes *The Iron Trade Review*, under date of November 5, as follows: "This company has had in mind for some time back, increasing its output of Lake Superior charcoal iron. The necessity for this has been growing steadily greater by the increasing demands of our customers for metal. It has now been decided to put in blast an additional stack. When this has been accomplished, we expect the output to exceed 40,000 tons per year. With this increase we hope to be able to take care of our present customers' needs, and it will give us great pleasure to be able to supply their wants. The present outlook in all classes of the iron trade seems hopeful. We think, however, any tendency to unnaturally inflate the price of the different grades of iron should be discouraged. While the market for charcoal iron has been and still is below what is should be, we hope that all producers of iron will observe a prudent conservatism and discourage any increase of price beyond what the natural demands warrant."

The Production of Iron and Steel in Great Britain.

Mr. J. S. Jeans, the secretary of the British Iron Trade Association, has issued his usual statement as to the production of iron in the United Kingdom during the first six months of the year. The returns show that the net increase in the make of pig iron from January 1 to June 30 of the present year, compared with the last half of 1888 was 87.767 tons, and the increase during the first half of this year, over the same period of last year, to have been 180,793 tons. The figures are:

	Tons.
First half of 1888	3,902,704
Second half of 1888	3,995,830
First half of 1889	4,083,547

The total production this year to June 30 is made up approximately as follows: Hematite 1,542,292 tons; forge and foundry, 2,121,055 tons; spiegel and ferro, 90,447 tons, and basic 329 803 tons. From the statement of the stocks of pig iron in makers' hands, and in warrant stores, it appears that the net decrease of stocks during six months to June 30 last, compared with the previous six months was 357,840 tons, and compared with the corresponding half of 1888 a decrease of 442,992 tons. The stocks at the three periods referred to stood as follows:

	Tons.
At June 30, 1889	2,231,868
At December 31, 1888	2,588,708
At June 30, 1888	2,673,860

The production of open-hearth steel ingots in the first half of the present year exceeded the total produced in the corresponding period of 1888 by 134,300 tons, while the production of Bessemer steel ingots in the first six months of the year declined 8,255 tons, as compared with the same period of 1888.

Novel Ideas at Erie Colliery, Mayville, Pa.

Electric light in the mine.

An electric mine locomotive.

A fully equipped blacksmith shop underground—blown by steam with a cold blast.

A patent device for pulling the cars off the dump, at the head of the breaker.

A hydaulic arrangement at the bottom of the shaft which lifts up the carriage to a height from which the empty car is automatically removed from the carriage.

A pump that discharges 650 gallons of water a minute.

By using the electric motor it is said that the company saves $25 per day on the cost of power, and is enabled to increase the output of the mine from 1,000 tons to 1,500 tons per day.—[Coal Trade Journal.

Swedish Iron in India.

In a report to the Swedish Export Association, its agent in Calcutta draws attention to the confusion caused in India through the numerous Swedish iron brands in use, and the number of which contributes to facilitate the substitution of Staffordshire and German iron for Swedish. He proposes that Swedish iron should be divided into four classes, according to the purpose for which it is required, each having a uniform brand, and that, moreover, instead of the letters now used as marks, the figures of animals, such as the Indian bullock and the alligator, be adopted instead. If so, the natives would easily know what to ask for, and stand less chance of being deceived, as these brands would be registered in the name of the association. He adds that the natives prefer Swedish iron for plow-shares and other implements, but generally obtain substitutes. The agent is of the opinion that, by joint action on the part of the manufacturers, the sale of Swedish iron in India would greatly increase.

A $4,500 Leather Belt.

A new leather belt which recently arrived in this city to be used in the Wire Rod Mill, is one of the largest ever in use in Western Pennsylvania. Its cost was over $4,500. It will be utilized to connect the 20-ton wheels which furnish power for the three trains of rolls.—[New Castle (Pa.) Guardian.

VIRGINIA CITY, Nev., has the biggest electric plant on earth. It has six 120 horse-power generators, and runs a mine and mill.

TWENTY years ago there were 92 lightning-rod factories; to-day there are but three.

AMONG THE IRON MINES.

Lake Superior Shipments of Iron Ore:—

Shipments of iron ore from the mines of Lake Superior, for the season of 1889, up to Wednesday, October 30th, are as shown by the appended statement, condensed from the Marquette *Mining Journal:*

MARQUETTE RANGE.

American	15,614	Grand Rapids	5,007	Queen	53,542
Angeline	19,178	Hartford	565	Republic	252,750
Barnum	6,333	Humboldt	15,866	Republic Reduction Co.	21,280
Braastad	94,711	Jackson	58,225	Riverside	3,712
Buffalo	39,226	Lake Superior	50,467	Salisbury	52,152
Buffalo, South	6,754	Lillie	30,125	Samson	449
Cambria	56,418	Lucy	21,058	South Buffalo	53,539
Champion	191,648	Marquette	59,927	Superior	215,126
Cleveland	247,893	Marquette Ore Co.	4,148	Volunteer	48,383
Cliffs shaft	114,838	Michigamme	41,453	Webster	117
Curry	16,169	Milwaukee	49,315	West Republic	1,509
Detroit	5,564	Negaunee	69,022	Wetmore	17,085
Dexter	3,895	North Champion	7,723	Winthrop	20,439
East Champion	2,637	Pitts. & L. Angeline	193,318	York	12,844
East New York	21,414	Prout	6,967		
Edison	893	Quartz	491		

Total, Marquette Range.....2,254,264

MENOMINEE RANGE.

Aragon	613	Half & Half	4,619	Norway	65,251
Armania	42,505	Hamilton	7,750	Paint River	26,756
Chapin	441,174	Iron River	149,367	Perkins	10,826
Commonwealth	93,210	Ludington	93,162	Shafer	9,237
Cyclops	30,312	Mastodon	56,513	Sheridan	504
Dunn	130,307	Mastodon, South	2,094	Sturgeon River	4,775
Florence	154,821	Millie	11,778	Vulcan	142,058
Great Western	34,443	Monitor	10,614	Walpole	9,616

Total, Menominee Range.....1,531,373

GOGEBIC RANGE.

Anvil	37,693	Iron King	40,405	Pence	73,665
Ashland	216,366	Ironton	8,807	Ruby	8,623
Aurora	171,327	Montreal	10,047	Section 33 south	44,467
Brotherton	53,226	Norrie	528,294	Sellwood Colby	25,003
Cary	43,753	North Montreal	26,415	South Colby	50,035
Colby, Beaver	44,070	North Section 33	22,153	South 15 Colby	10,280
Germania	91,176	Odanah	4,446	Windsor	14,576
Globe	9,814	Pabst	92,786		
Iron Belt	46,147	Palms	9,960		

Total, Gogebic Range.....1,687,791

VERMILION RANGE.*

Chandler Mine	281,390	Minnesota Iron Co.	474,346	Pioneer	3,144

Total, Vermilion Range.....758,880
Grand Total.....6,235,308

*Shipments for past week not included.

The Two Harbors shipments would, no doubt, carry the total for the week over 200,000. The mines are sending ore forward in remarkably heavy volume for this late stage in the season.

Lake Superior Mining Notes:—

MENOMINEE RANGE.

The Florence is preparing for a 300,000 to 400,000 output in 1890, and all the improvements now making are being carried out with that end in view.

The new shaft at the Caledonia is now down about thirty-eight feet in ore, and the product continues to look as well, if not better, than that taken out a fortnight ago, which analyzed 64 per cent. in metallic iron and only .025 per cent. in phosphorus. Capt. Calhoun intends to sink to a depth of eighty to 100 feet and then crosscut to the hanging wall.

A small vein of black magnetic ore has been found near the Deer River, in township forty-two, north of range thirty-two west, Michigan. This ore is found in workable bodies at the Republic, Champion, Sparr and other mines on the Marquette range, and is a very desirable ore, running always above 68 per cent. in metallic iron with no phosphorus to speak of. The find mentioned is the first ever made in this locality, so far as the writer knows.—[Mining News.

The following item of mining news is from the columns of the *Iron County Reporter*. "A visit to the Sheridan mine, recently, by a representative of this paper showed that work on that promising property was progressing as well as could be expected, on account of the difficulties the management has to contend with. Mr. Sheridan has a large stock pile which he is daily adding to. A 40-foot cross-cut, to the west, has been driven in solid ore without striking the wall. Drifting to the south and north is being done to ascertain the extent of the vein. The shaft has been sunk nearly 60 feet, 45 feet of which is in clean ore. There is no question but what Mr. Sheridan has struck a large body of ore, and it only wants the building of a spur track to thoroughly demonstrate this assertion. Next season the Sheridan will make a fine showing."

GOGEBIC RANGE.

Nat D. Moore, the well-known Gogebic operator, who made and lost a big fortune, is again upon his feet and is trying his skill in the Virginia field. He is backed by wealthy Scotch-Canadians, who have already invested considerable money in that region, paying $70,000 for one tract of land in the western portion of East Virginia, and contemplate the purchase of much more territory. —[Iron Ore.

MARQUETTE RANGE.

The Nonpareil Iron Co., whose property lies a short distance north-west of this city, will soon commence to explore the same with a diamond drill. Mr. Jno. R. Wood was in the city during the week and made the necessary arrangements for the proper conducting of the work.—[Ishpeming Iron Ore.

The *Herald* says the Pittsburgh & Lake Superior Co. have made during the past few days what promises to be a valuable discovery of hematite ore on section 32, less than half a mile south of the office of the company, at Palmer. The ore is a soft hematite of first-class quality, and is about eight feet from the surface. From present appearances the deposit is an extensive one. The work of development is to be commenced at once.

Messrs. Maitland, Healy, et al., have taken an option of the vacant property rear of the Breitung house and have commenced the work of exploration. The ledge has already been reached in two or three pits and encourages the belief that a deposit of ore will soon be opened. The work will be watched with much interest by our citizens.—[Negaunee Herald.

A dispatch to the *Mining Journal* from Milwaukee, announces that the sale of the Prince of Wales mine, on the East Negaunee range, has been closed, the Schlesinger syndicate having taken the property at the price named in its option, $125,000. The syndicate holds options on the Queen, South Buffalo and another of the East Negaunee range mines, and will, no doubt, take these, also.—[Journal.

Undeveloped mineral properties in the vicinity of Republic seem to be attracting more than ordinary attention, at this time, and no one need be surprised to learn of the opening of three or four profitable mines there before the beginning of another season of navigation. Thomas Tracy, of Marquette, and others have an option, or lease, of the Northwest Republic, upon which considerable exploratory work was done two years ago, and finally discontinued on account of the discouraging condition of the market at that time. The work of unwatering the shaft is being pushed and when complete, sinking and drifting will be commenced. The chances of opening a paying mine are thought to be good.—[Negaunee Herald.

In the new discovery made by the Pittsburgh & Lake Angeline Iron Co., some distance to the east of their main workings, a half mile at least, and close to the east end of Lake Angeline, the company possesses an ore deposit of remarkable quality, it yielding from 67 to 68 per cent. in metallic iron, and is sold to average no higher than .027 per cent. in phosphorus. We often hear of mines that show a low percentage of this undesirable acid, but we know of none other in the region that is guaranteeing its product to run as low in phosphorus as this. Jones & Laughlin are making a special brand of steel from the ore, and are greatly pleased with it. It is probably the highest-priced ore sent from any field in the Union. The company has opened this mine the present season, and will probably send out 4,000 tons. Next year it will do considerable in the way of holding up the company's product to the large tonnage noticeable for several seasons past.—[Ishpeming Iron Ore.

A New Method of Pipe Manufacture.

John Wm. Archer, of Scranton, Pa., writes the *American Artisan:* I have read your item, "A New Water Pipe," in your issue of the 12th inst. This is, no doubt, an invention of merit. It may be that Mr. Ferguson, of Melbourne, is a capitalist; if so, there will be no difficulty in placing these pipes on the market, but when there are any other inventions or improvements of a similar class and in our own country, "the improvement or invention belonging to a working man," it is very often ignored and never gains its maturity, as capitalists are so hard to reach. There is a method of pipe making, if proper parties were disposed to consider it, that would certainly beat our Australian friend's. Pipes can be manufactured of any strength of material from one-eighth of an inch in thickness to one inch or more, if required, and of any desired diameter. They can be made without a rivet, solidly welded together and made to taper through their entire length or at the ends only. Being welded, there is no need of close or flush riveting at ends, therefore, no trouble or loss of time in keeping the longitudinal seam in its proper position when the pipes are shrunk one on to the other. Another advantage is that these welded pipes can be made in any length that it is possible to get plates the necessary width. Under the same process of manufacture an indescribable variety of goods can be produced, such as range heaters, tanks for oil, circulating cisterns, steam and hot water boilers and heaters, tue-irons for blast forges, elevator buckets, furnace pans, foundry ladles, contractors' tipping and earth skeps, galvanizing vats, shells for ice making and cold storage plants, etc. Above all, the quick production and lessened cost of manufacture is a large inducement for the introduction of this unknown branch of the iron and steel industry.

CONGRATULATIONS are in order to *The Century* upon the attainment of its twentieth year. No literary venture of modern times can duplicate its history of successes. Among the attractions of the November number are the following: Mrs. Barr's novel, "Friend Olivia;" Stockton's "The Merry Chanter," illustrated by C. D. Gibson; Mark Twain's, "A Connecticut Yankee in King Arthur's Court;" Judge Ernest S. Crosby's "Case of John Van Arsdale;" Mrs. Carter's description of "Street Life in Madrid;" George Kennan's chapter of "Adventures in Eastern Siberia." There are brief papers on "The Southern Cadets in Action," "Who ever saw a Dead Cavalryman?" "Shooting in Libby Prison," "Prohibition," "American Game Laws," "Copyright Reform," "Free Kindergartens," "Governor Seymour," "The Methodist Church South," etc.

THE average amount of feed water required for a good economical engine is 30 pounds per indicated horse-power per hour; engines of high economy will use less than this amount, and those more wasteful will use more. A high piston speed, together with a high rotative speed, is very desirable, as great power may thus be obtained from moderate sized engines, and also the evil of internal condensation is corrected to a great extent, but these are somewhat limited by practical considerations.

AN improved headlight for locomotives, has an adjustment which allows the engineer to conveniently direct the light, as he may desire, to various points of the line.

CVST iron pillars with flat ends uniformly bear about three times as much as those of the same dimensions with rounded ends.

KRUPP, the gun man, employs 21,000 men. He started in 1833 with nine men.

AMERICAN cast steel for tools is advertised in London.

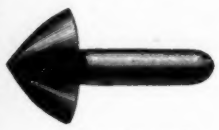
THE GOULD ROLLING MACHINE.

Improvements in the every-day processes of machine shops are quite easily made, and have come to be expected in this progressive age. Originality in mechanical processes and designing of machinery is rather the exception, and such inventions are deserving of especial mention.

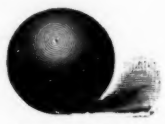
The accompanying cuts represent a machine designed and patented by Chas. E. Gould, of Leominster, for making rolled forgings, and its working is destined to revolutionize the production of thousands of articles which have heretofore been turned out by means of the trip hammer, the milling machine and the lathe.

In order to give our readers some idea of the working of the machine, we submit a few of the claims the inventor makes for it.

It wastes little or no material, accomplishes many things heretofore deemed impossible, and is so quick and accurate in the operation that its productive capacity is far in advance of any other process known in mechanics. It saves labor, material and time, and must certainly, in time control the manufacture of any article that can be produced by it. The accompanying cuts show a few of the articles which this machine is capable of making with lightning speed. Eight million boot calks are used annually, which have heretofore been forged with a trip hammer, averaging 2,000 a day. The Gould rolling machine, with the double die, easily produces 20,000 of these. Steel balls, from 3-16 to 2 inches in diameter, boiler rivets, steel handles of all kinds and sizes, shuttle tips, and, in fact, everything of this kind which has heretofore been forged or turned, can be made much more rapidly and cheaper by this process.



SHUTTLE TIP.

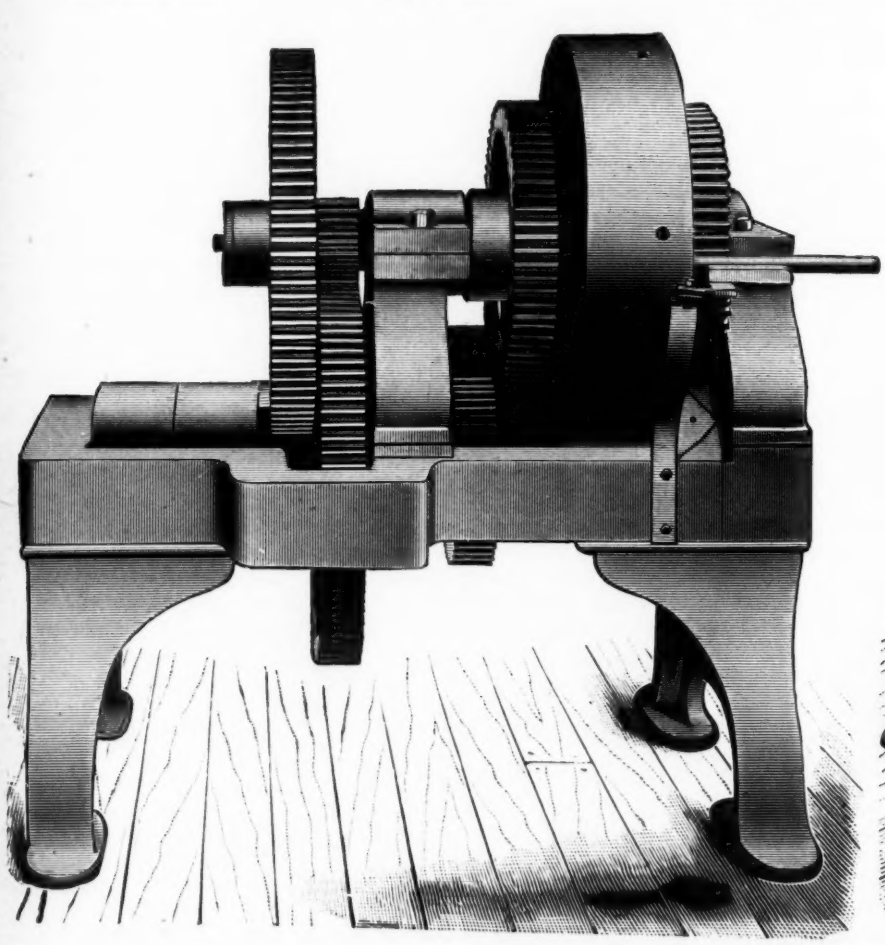


STEEL BALL.

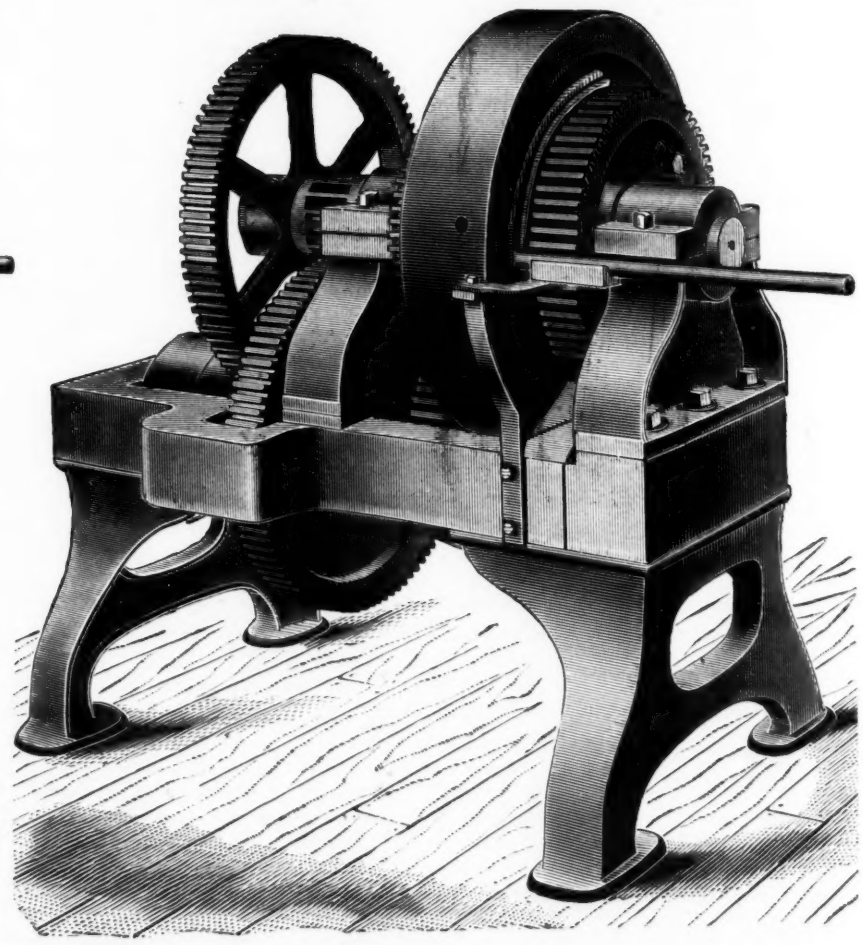
SHOE CALK.

CONICAL SHELL.

STEEL HANDLE.



SIDE VIEW.



FRONT VIEW.

GOULD ROLLING MACHINE.

Other machines have attempted to produce rolled forgings, but previous to the introduction of the Gould rolling machine, none was ever invented that could produce a solid forging, of irregular shape, that was perfect in every detail, but the Gould machine will do all this, and its productions are guaranteed equal or superior to those turned out by any other process.

As an illustration take the common steel handle, many of which are used. They have heretofore been made on the turning lathe, which every machinist knows to be a slow and expensive process, as no small part of the material is wasted, now with the Gould machine ten handles can be rolled out while one is being turned on the lathe, and there is no waste of material at all.

Without doubt the Gould rolling machine is one of the greatest labor and metal saving inventions of any age, as it really revolutionizes the production of many small articles.

It can be readily understood that whatever it makes is better than what is made by any other process, for the reason that instead of cutting away the material, thereby weakening it, it produces its shapes by compression, thereby adding strength and saving all the metal.

Heretofore it has been considered impossible to compress hard metal so as to produce a thread on a screw or bolt, but by the Gould process it is found perfectly practicable to shape a perfect thread in the hardest tool steel, as if it were copper, brass or even some softer metal, and the strength of the article produced is increased proportionately.

It is certainly meeting with wonderful success for a new invention, and the Gould Rolling Machine Co., of Leominster, Mass., which controls it, will find a ready sale for their machines, and many of their productions as soon as they can make them, which they are preparing to do by constructing shops, etc., at Leominster. C. E. Dresser is the treasurer of the company, and will have the active management of the company's works.

Mighty Engines of War.

The Gatling Dynamite & Torpedo Boat Co., which is the name of the concern that has been organized with a capital of $6,000,000 to build the most formidable torpedo boats ever constructed, has appointed as it superintending engineer John Haug, a well-known marine architect and mechanical engineer, whose place of business is at No 206 Walnut place. He will have charge of the construction of the vessels, which will be begun as soon as the plans shall have been sufficiently perfected to allow the awarding of the contracts. As many of the features of the vessels and their armament are entirely new in design and principle, the inventors intend to secure patents in all the foreign countries before the actual work of construction shall be begun.

The company has decided that the contracts for such of the vessels as may be built for European Governments shall be placed with Thornycraft and the Yarrow Co., the celebrated English builders of fast torpedo-boats. The armament of the vessels will be made at Hartford, Conn., where the boats built in this country will be taken to be fitted for service. A representative of the Chinese Government, which is a large purchaser of American firearms, has requested the new company to send one of its vessels to China, in order that the officials of the Chinese navy may have an opportunity to see what the gun-boats can do.—[Philadelphia Record.

A Feat of Iron Moulding.

A curious and noteworthy instance of expert foundry work is noted by the *Commercial Bulletin*, of Boston. It consists of three plates of cast iron about one-fourth of an inch and seven by five inches in surface, covered with writing indented in the iron. This specimen of skilled workmanship was done by John Farrar, foreman at G. W. & F. Smith's foundry, a life-long workman in an iron foundry. The impression on the iron is made by writing backwards on thin paper, pinning the paper in a mould, and then pouring on the iron. The writing thus transferred to the plates, when the iron is cooled, is wonderfully clear and distinct and is so deeply imprinted as to defy any attempt at erasure. The reporter showed these plates to several gentlemen familiar with iron work and themselves skilled workmen, who declared that they never saw anything like it before.

THE Montana Supreme Court has just decided the Mechanic's Lien law constitutional, and that the laborers' wages must be paid first.

MICHIGAN leads the country in the production of iron, copper and salt.

IMPROVED MILLING MACHINE.

The cut presented herewith is of a new milling machine recently brought out by the Lodge & Davis Machine Tool Co., Cincinnati, O. It is made in three styles—plain back-geared and back-geared with universal head and index centers, and embodies features of construction, which are novel and worthy the attention of our readers. The spindle bearings are tied together by an arch, which is cast solid with the uprights and column, and the front of which is bored to receive the overhanging arm for the outer center support. This construction makes it easy to remove the arm when it is desired to do so, by simply loosening the two clamp bolts shown. The bearing of the arm in the arch is 12″ in length.

The boxes are made in halves of bronze, and instead of the usual flanges at each end, have a deep rib running around them in the center of their length. This rib fits tightly into a groove, which is formed in the column and boxcap, the groove being bored out in columns and caps simultaneously by specially constructed tools. This makes a box which can easily be replaced by any one who has facilities for doing a good job of simple lathe work, as the entire outside surface of the boxes can be turned off without reversing the arbor in the lathe, and thus the alignment of the spindle is restored at any time. Each box is adjusted by means of a screw of large diameter placed above the cap.

The cone pulley is placed with its smallest step towards the front, in order to allow bringing the bracing for the main bearing support as close as possible to the box, and thus secure the greatest rigidity. The spindle is of forged steel, and the bearings are 4¼″ and 3½″ long.]

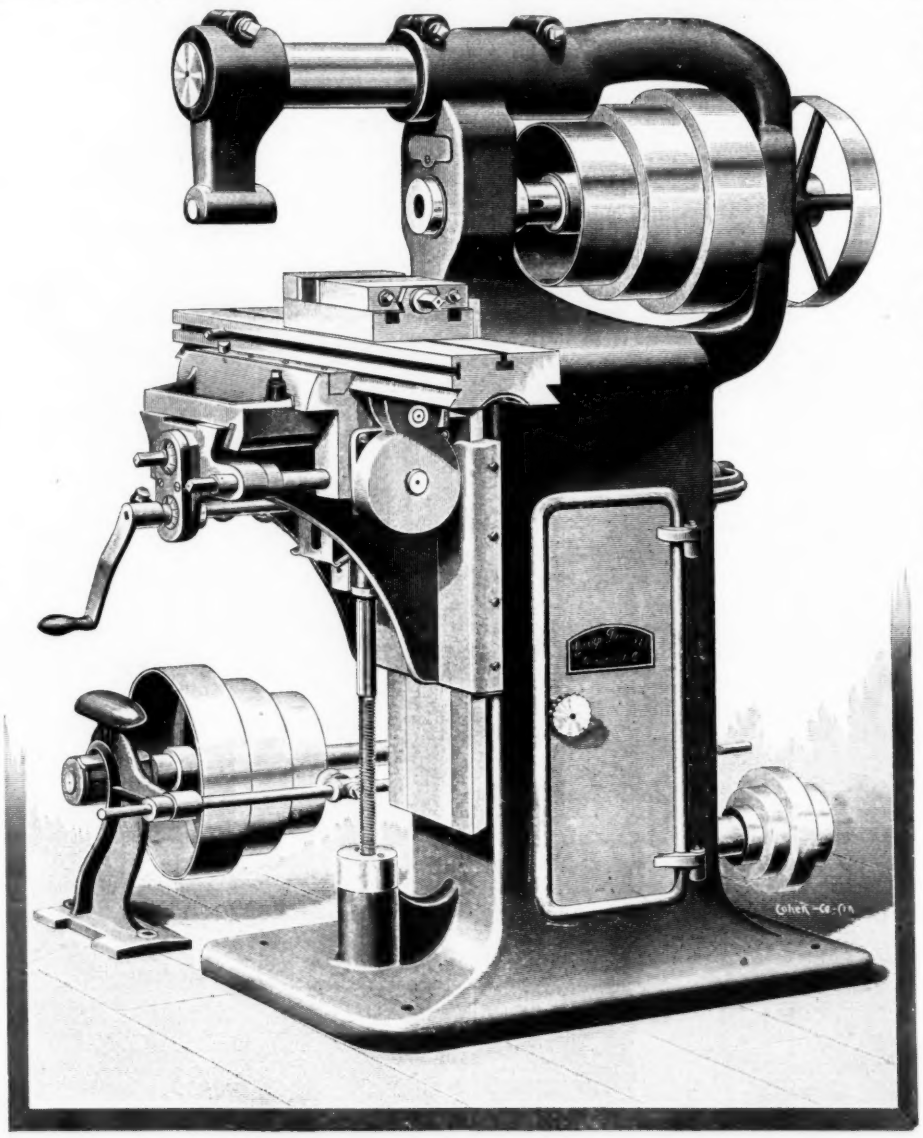
The table has a vertical movement of 15″, and the top of the table can be raised to the height of the spindle center. The saddle has 5″ of motion to and from the column, and it can be clamped solid to the knee by means of the screw shown on the right hand side of the saddle, thus obviating the necessity for disturbing the gib screws, and also being more convenient.

All three movements of the table are effected by the same hand crank which fits on to either of three squared shafts, which are grouped together in a convenient place, and the crank handle can be clamped onto them when desired.

Instead of the usual devices for the feed of the table, there is under it, and in the center of saddle, a bronze screw 12″ long and 4″ in diameter. The threads of this screw engage with spiral teeth, which are hobbed out in the bottom of the table, and extend along it from end to end.

By this means a strong feed mechanism is obtained, and the thrust is brought as close to the top of the table as possible. The train of gears for revolving this screw, and thus feeding the table by hand, is distinct and separate from the train used for power feeding, and, when moving the table by hand, one revolution of the crank gives a movement of just one inch to the table. This construction admits of a table of any desired length with a feed the entire length of it, and it can be taken out at either side of the saddle without removing or disturbing any other part. The table is 6¼″ wide and 32″ long.

Motion is carried to the feed train by means of the well-known universal joints, and the feed is tripped automatically in either direction. All gears and other feed mechanism are covered by shields, to exclude chips and dirt. The machine illustrated is driven by a 3″ belt, the largest step of the pulley being 11″ diameter. The plain machine (without back-gears) is driven by a 3½″ belt, the largest step being 13″ diameter. The weight of the machine is 2,000 pounds. For any further information write to their branch house, Nos. 68 and 70 South Canal street, Chicago, Ill.



IMPROVED MILLING MACHINE.

THE FLUID COMPRESSION OF STEEL

An excerpt from the minutes of the proceedings of the Institution of Civil Engineers, just issued, gives a voluminous and very interesting report of a paper and protracted discussion on this subject in May last. The paper was one read by Mr. W. H. Greenwood, who described in detail the methods and means of compressing fluid steel practiced at the Abouchoff Steel & Ordnance Works, St. Petersburg, Russia, under the direction of Admiral Kolokoltzoff. Mr. Greenwood commenced his paper by a general reference to the unsoundness of steel ingots, proceeded to the several methods which had been employed to remedy the defect, and then described the apparatus for effecting fluid compression at the Abouchoff Works. Into these details we need not go, but may merely note that Mr. Greenwood claimed that perfectly solid ingots are the result, and that various tests demonstrated that the steel was absolutely good in all respects. He furnished tables of tests in proof of his assertions. The discussion revealed remarkable divergences of opinion amongst men whose names are "household words" in the literature of steel. Mr. J. D. Ellis, of John Brown & Co. (Limited), Sheffield, held that unsound ingots were not being as generally produced as was stated by the author. His experience was that all the impurities found their way to the top of the ingot, and when that was cut off all the rest was sound. Mr. W. Parker considered that fluid compressed steel was the right material for marine engine shafts. Mr. James Riley thought the author was confuted by the results he had himself stated, and held that the compression was "barbarous treatment." Mr. T. E. Vickers did not believe in fluid compression, and criticized the process and its results in detail. Mr. Roberts Austen dwelt chiefly upon an alleged misuse of the words "temper" and "tempering" as applied to steel. Col. Dyer, who has been associated with the firm of Whitworth & Co. for some years, thought that there was no better steel than Whitworth's, but the fluid pressure had absolutely nothing to do with its quality. Mr. B. Walker held that sound ingots could be and were made without compression. Mr. J. F. Hall, of William Jessop & Sons, Limited, Sheffield, thought the theory of fluid compression an absurdity, although he hoped the author would discuss the treatment of steel by hydraulic pressure after it had become solid. Mr. J. W. Spencer said that thoroughly sound ingots could be produced without compression. Blow-holes could be got rid of by care and attention. Mr. E. Reynolds, of Vickers, Sons & Co., Limited, Sheffield, stated that fluid compression was invented by James Hollingrake in 1819, so that whatever merit there might be in that process belonged to that inventor. He held that steel could be made sound and free from cavities by properly "killing" it. Mr. E. A. Cowper thought the author had proved his case. Mr. John Head, London, thought that gases should not be imparted to the steel in its manufacture, which could be avoided if the heating were by Mr. J. Goodman gave some interesting tests of Whitworth steel, and showed that paraffin oil would run clean through a red hot boiler plate half an inch thick. Mr. W. Anderson added that mercury, at ordinary temperatures, passed through tin, and that carbon penetrated through and through iron bars at a comparatively moderate temperature. He believed in fluid compression as being the "only rational and certain process." Lord Armstrong did not dispute that compression might prevent the formation of air-bubbles, but did not see that the other advantages claimed for it had been fully established. Various other gentlemen spoke, but it was evident that the weight of opinion was adverse to the utility of fluid compression.—[Ironmonger (London).

Everybody a Stockholder.

A correspondent of the Baltimore *Manufacturers' Record* writes: "I have just had an interview with Col. S. B. Lowe, of Lowe & Tucker, who supply near one hundred foundries and machine shops with pig iron. He has just returned from a flying business trip to Atlanta, Macon, Savannah, Charleston and Augusta. He is most enthusiastic on the general condition of trade, but especially of the iron industry. He reports all the foundries and machine shops as doing a rushing business, with full orders at profitable prices. He tells me that never in his experience has he seen such a buoyant, confident feeling in all lines of trade. Speaking of manufacturing, he said it was only within the past four or five years that Southern men of means, and particularly professional men, had begun to put their money into manufacturing enterprises. He said that while the North had invested much money in the South, yet to Southern men, in a great measure, is due the present development, more particularly as to iron-making. This, in a large measure, has been a matter of reproduction—one furnace earning the money to build another. He has no hesitancy in saying that any well-placed and properly conducted Southern furnace can earn from $75,000 to $125,000 clear profit per year."

A CORRESPONDENT of the St. Louis *Globe-Democrat* asserts that there is tin enough in Pennington and Custer counties, Colorado, to supply the world for centuries to come.

ADJUSTABLE DRILLING AND COUNTERSINKING MACHINES.

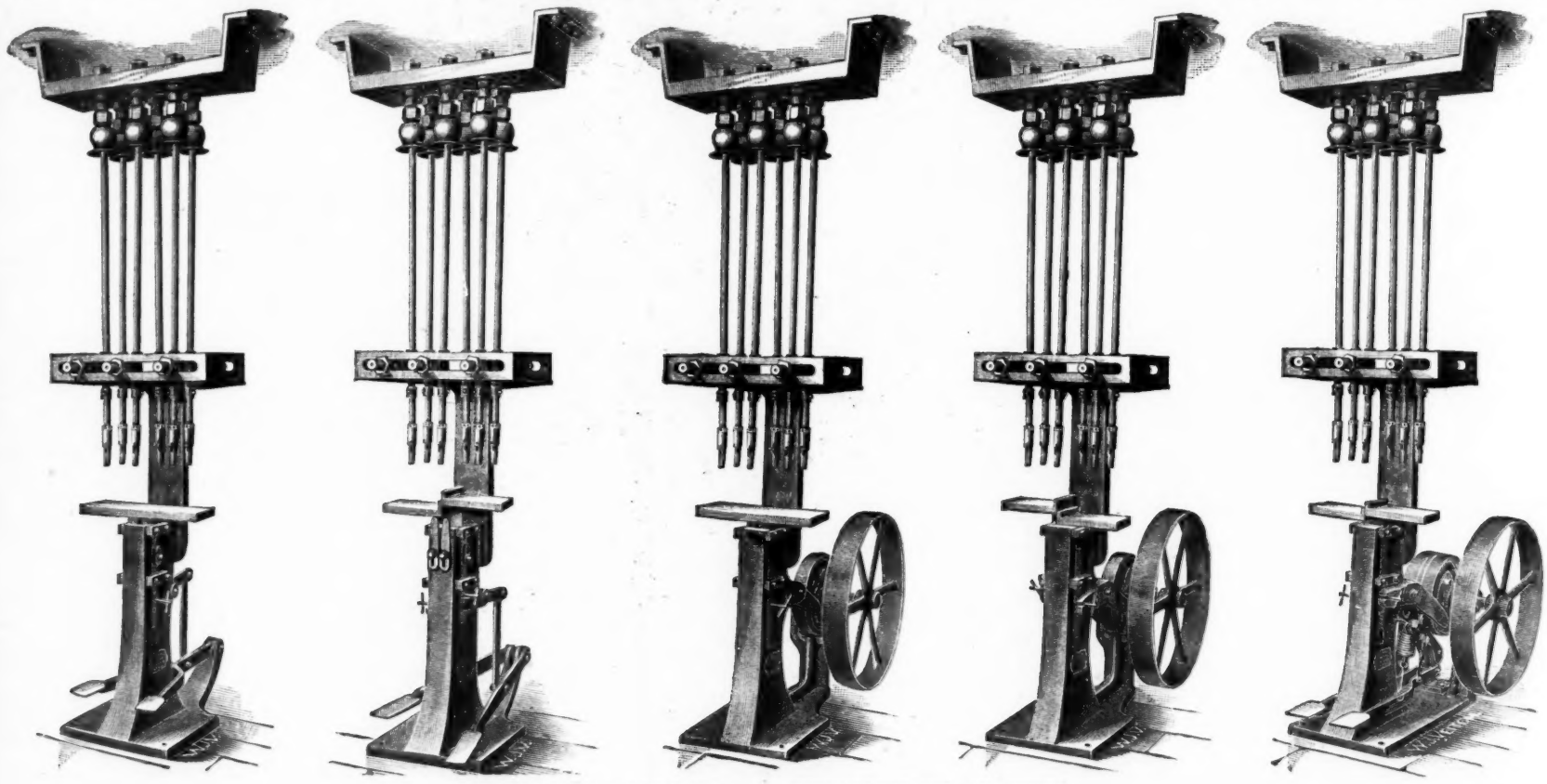
The machines illustrated herewith are designed for drilling and countersinking several holes at one operation, in a regular or irregular line, through thin stock, such as butts, strap and T hinges, door bolt plates, shelf and wall brackets, harness hooks, coat and hat hooks, and an endless variety of other articles. In illustrating these machines, we show them all arranged with six spindles, but a greater or less number are furnished, according to the classes of work to be done.

The spindles are suspended from the ceiling by a hanger, which can be furnished to hold them in one or two rows. Each spindle being run in a ball bearing at its upper end, and operated by a separate belt, it admits of adjusting the lower ends very close together, or several inches apart in any direction to suit different work. The chucks for holding the drills, are arranged with a very fine adjustment, and bored to fit a regular Morse taper, No. 1.

Figs. 1 and 2 are illustrations of the machines with both single and double tables with foot lever feed; the single table machine of this style being the one most commonly used, although for some classes of work, the double table machines are preferable, as the holes may be drilled on one table and countersunk on the other. The height to which the table, or tables, may be raised, is governed by an adjustable stop-gauge on the side of the machine.

Figs. 3 and 4 represent both single and double table machines, with automatic feed; this style of machine being preferred by some, as it obviates the the work of raising the table, or tables, by foot. The lever which raises and lowers each table, has three fulcrums, by which the motion of the table may be varied.

Fig 5 is an illustration of the machine with double table, with automatic feed and clutch attachments. In this style of machine, the cam which operates the lever for raising and lowering the table, is governed by a clutch, and may be started at the will of the operator, by a light pressure of the foot to the treadle, which causes the cam to make one revolution, arising the table to its full height and lowers it again to its former position. The table begins to move upward the moment pressure is applied to the treadle, and in returning, it always stops at the lowest point. The lever which raises each table has three fulcrums, by which the motion of the table may be varied to suit different work. Manufactured by John Adt & Son, New Haven, Conn.



ADJUSTABLE DRILLING AND COUNTERSINKING MACHINES

No. 1—Single Table with Foot Lever Feed.

No. 2.—Double Table with Foot Lever Feed.

No. 3—Single Table with Automatic Feed.

No. 4—Double Table with Automatic Feed.

No. 5—Double Table with Automatic Feed and Clutch Attachment.

EARLY IRON ENTERPRISES AT PITTSBURGH.

We are indebted, says the *Bulletin* of the American Iron & Steel Association, to Isaac Craig, Esq., of Allegheny City, Pa., and to Mr. Thomas J. Chapman, of Pittsburgh, for the following *verbatim* extracts, from old Pittsburgh almanacs, beginning with 1812:

From The Pittsburgh Magazine Almanack for 1812, page 54.

Messrs. Printers—Your attention to the publick utility has long been very predominant in your Almanacks. I hope you mention that the Brownsville Steel Factory is still in operation; a certificate of Colonel J. Marshall will be satisfactory to some, viz.: "I have been accustomed to making various edge tools for forty years, and have no hesitation in pronouncing the steel made by Morris Truman & Co. equal to any imported or made elsewhere."—*Cross Creek, July* 1, 1811.

From The Pittsburgh Magazine Almanack for 1813, page 37.

ON CHEAT RIVER. Jackson & Updegraff have in complete operation a furnace, forge, slitting and rolling mills, and cut-nail manufactory. It is observed of their nails that they are handsome, and that their iron is of a tough quality.

At Brownsville The *steel manufactury* of Morris Trueman, which was started about 18 months since, is doing well, and is capable of furnishing seventy tons of good steel annually.

From The Pittsburgh Magazine Almanack for 1813, pages 59-61.

PITTSBURGH. *Air Founderies.* Of these we have two, McClurg's and Beelen's, on plans which enable them to cast about 600 tons a year of all kinds of hollow wares, machinery, cannon balls, smiths' anvils, sad-irons, etc., worth 54,000 dollars. Mr. Price has also a small air-foundery for casting butt-hinges and buckles for saddlery; he casts brass also. Messrs. Beelen and McClurg also cast *iron boilers*, which answer as a valuable substitute for copper stills for distilleries. *Ironmongery.* This is getting to be a manufacture of great importance. * * * Messrs. Brown, Barker & Butler have established an extensive *Hardware* manufacture, where they already make nails, and intend to make edge tools and cutlery generally.

Messrs. Foster & Murray are erecting steam works for the purpose of setting in operation a tilt-hammer. They intend to make shovels, spades, scythes, sickles, &c., &c.

C. Cowan is erecting a most powerful steam engine to reduce iron to various purposes. It is calculated for a *seventy horse-power*, which [will] put into complete operation, *a Rolling mill, a Slitting-mill, and a Tilt-hammer*, all under the same roof. With these Mr. Cowan will be enabled to furnish sheet-iron, nail and spike rods, shovels and tongs, spades, scythes, sickles, hoes, axes, frying pans, cutting-knives. In addition to Mr. Cowan's already extensive nail business he makes a great supply of chains, plough irons, shingling hatchets, clew hammers, chissels, screw augers, spinning wheel irons, and smiths' vices of superior quality.

Mr. Patterson, late from England, is erecting a house for the manufacture of locks, files, coffee-mills, butt-hinges, &c. Abner Updegraff makes plain bits, door handles, kitchen furniture, squares, hackles, and a variety of edge tools; and has just commenced files and saddler's knives. Stackhouse & Rodgers, steam engineers, propose to add to their already extensive business the making of wood-screws. Mr. Fustin, beyond his engagements in making steam engines, manufactures many articles in iron-mongrey: there are several other smiths who make a variety of cutlery, &c.

Wire drawing. Messrs. Eichbaum & Son have got their WIRE MILL in handsome operation, and make beautiful wire of different sizes.

From The Pittsburgh Magazine Almanack for 1814, page 67

Two wool carding machines are in operation at Zelienople, Butler County Pa., owned by P. L. Pasavant; and near the same place Bassenhein furnace is erected by Mr. Glasser.

From The Pittsburgh Magazine Almanack for 1814, page 69.

The Pittsburgh Steam Engine Co. have erected a very extensive air-foundry. And in the little town of Birmingham, opposite Pittsburgh, Peter Kimmel has got one in operation. These are in addition to two very large foundries owned by Mr. A. Beelen and Mr. J. McGlurg. Messrs. Beall and Dinton, at their foundries, cast a great variety of articles, including butt-hinges.

From The Pittsburgh Magazine Almanack for 1815, pages 64 and 65.

Besides the four *air-foundries* already established and in successful operation, Mr. Joseph McClurg is building another on the bank of the Allegheny, immediately above the town. At Mr. Anthony Beelen's foundery about 400 tons of castings are made annually. At the same establishment he has erected a mill for boring cylinders, air-pumps and pipes for steam engines, for turning sugar rollers, pivots and shafts, and for grinding sad irons, scythes, sickles, &c.

INDUSTRIAL SUMMARY.

New Enterprises:—

A foundry for the manufacture of mining, hoisting and furnace machinery, will be established at Eagle Pass, Tex.

The Barbee Iron & Wire Works, of Lafayette, Ind., have made a proposition to the Board of Trade of Fort Worth, Tex., to establish a large factory there.

Messrs. Gordon, Strobel & Laureau, of Philadelphia, have secured the contract for the erection of a blast furnace at Principio, Md., from the Geo. P. Whittaker Co.

The Powell Mining Co. has filed articles of incorporation with a capital stock of $10,0000, and its principal places of business located at Fort Dodge, Ia., and St. Louis, Mo.

A company has been organized to build a railroad spike factory at Scottdale, Pa, with a capacity of 100,000 kegs annually. The spike machine to be used is an invention of Artemus Welsh, of Scottdale, and the late A. A. Hood, of Connellsville.

James P. Witherow has recently made a contract with the Buena Vista Furnace Co. for the erection of a coke furnace, 70x16, at Buena Vista, Va., with the Graham Iron Co. for the erection of a furnace of the same size at Graham Station, Va., and with the Roanoke Furnace Co. for a furnace, 82x17, at Roanoke, Va.

A company, with a capital stock of $20,000, has been organized at Pittsburgh, for the manufacture of the Wilcox Safety Brake for inclines and elevators. A charter will be applied for in a few days. The incorporators will be A. B Force, Washington Force, A. S. Force, E. L. Packer, D. J. Richardson and W. R Wilcox, the patentee.

The proposed introduction of an industry into the town of Attleboro, Va., which would employ 1,000 hands, and which has been kept secret for the past few weeks, proves to be the plant of the Backus Electric Motor Co., of Baltimore. To get this industry into the town calls for the subscription of $200,000 from local business men.

Recent Illinois incorporations: Seal Lock Co., Chicago; to manufacture locks; capital $300,000; incorporators, James A. Kirby, John B. B. John, B. Wiggins, Charles S. Wilcox.—Peoria Heating, Power & Gas Light Co., Peoria; capital, $500,000; incorporators Irvin W. Johnson, John H. Francis and S A. Kinsey.—Automatic Releasing Hook Co., Chicago; to do a general manufacturing business; capital $50,000; incorporators, James R. Raymond, Horace Alexander and Fremont Hill.—Stark Manufacturing Co., East St. Louis; to manufacture nuts, bolts and locks; capital $750,000; incorporators, Frank G. Stark, Richard E. Perry, Thomas A. Russell.—Webber Manufacturing Co., Rockford, to manufacture canning mills; capital, $10,000; incorporators, Henry Webber, Isaac O. Smith, John W. Forbes and James J. Huke.

Enlargements, Additions, Removals, Etc:—

The Columbus Architectural Iron Works, of Columbus, O., are considering the removal of their works to Little Rock, Ark.

The Moore Manufacturing & Foundry Co. will build a new foundry at Milwaukee, Wis., and will increase the size of machine shop.

The Enterprise Boiler Co., of Youngstown, O., have commenced work on the erection of an addition, 48x120 feet, to their present plant. This has been made necessary by the large increase in their business. At present the firm have sufficient orders on hand to keep them busy for some time to come.

Cofrode & Saylor, of Philadelphia, have leased the Philadelphia & Reading rail mill at Reading, Pa. The Carpenter Steel Co, which has been occupying a part of the mill for experimental purposes, has been notified to quit within 70 days, and immediately after that company vacates the mill will be changed for the manufacture of structural iron.

The steady growth in the business of the Southwark Foundry & Machine Co., of Philadelphia, has necessitated an increase in their working facilities, and at a meeting of their directors, held recently, a resolution was passed authorizing an increase of the capital stock of the company from $250,000 to $300,000. The additional $50,000 thus secured will be used in the building of a new erecting-shop.

The great Norway iron works of South Boston, Mass, have been sold to a syndicate, who propose moving them immediately to the West. These great iron works are the pride of Boston, the finest in the East, if not in the country, costing upwards of $1,000,000. They will be removed to either Peoria or Reed City, Ill., or Des Moines, Iowa. The parties owning them have large interests in each of these towns.

Fires and Accidents:—

Jersey City, N. J.—Boynton Furnace Co.'s works. Loss, $10,000; insurance not stated.

The forge shops of the Columbus Bolt Works, at Columbus, O, were burnt 23d inst.; loss $25,000. Other valuable manufacturing property was destroyed.

October 28 a boiler at McIntosh, Hemphill & Co.'s foundry, Pittsburgh, exploded and wrecked the building. No one was injured by the explosion. The boiler room is situated on the Alleghany river bank, between Twelfth and Thirteenth streets. It is a one-story building and contains four boilers, of which the one nearest the river exploded, tearing out the entire side facing the river and blowing the roof off. The loss will amount to about $7,000; fully insured.

General Industrial Notes:—

Week before last the Allegheny Bessemer Steel Co., of Duquesne, Pa., turned out 3,143 tons of steel rails. Work has been commenced on a large order of 70-pound rails for the Pennsylvania Railroad Co.

The Maumee Rolling Mill Co., of Toledo, O, are running their works double turn, with a force of 450 men. The capacity of the entire plant is 2,400 tons per month, and the present output is 2,000 tons. The plate mill will be in operation by the 15th of the present month.

The well-known importing firm of Merchant & Co., of Philadelphia, has just closed a contract with the United States Government to furnish the mints with 100,000 pounds of copper blanks for making pennies, and 50,000 pounds of nickel blanks for coining five-cent pieces, all to be imported, we suppose.

Considerable new machinery has recently been placed in the Eagle Iron Works, this city, and one hundred laborers are employed at present The works are running night and day, in order to keep up with the orders. A new brick addition to the moulding room is being built, at a cost of about $1,500, which, when completed, will increase the capacity for melting pig iron about four tons per day.—[Meadville (Pa.) Journal.

Mr. G. D. Forslich, representing H. T. Sackett & Co., of Fond du Lac, Wis., manufacturers of the Trowbridge Boiler Cleaner, was in Cleveland, the past week. Strong claims are made for this cleaner, which the manufacturers back up with a contract in which they subject themselves to very stringent conditions. That the cleaner is rapidly meeting with public favor is evident from the fact that nearly every manufacturer in Fond du Lac is using it and that, among recent purchasers, are E. P. Allis & Co., the C., M & St. R Railway Co., and a number of large manufacturers of Milwaukee, the Racine Hardware Co., the Bain Wagon Co., of Kenosha, Wis., the Sheboygan Mineral Water Co., and others.

The Stilwell & Bierce Manufacturing Co., of Dayton, O., milling and hydraulic engineers, mill builders and contractors, and manufacturers of turbines, etc., write us that the Academie Nationale of France has awarded its grand gold medal to their Victor turbine, now on exhibition at the Paris Exposition. Such an endorsement of the quality of their work is highly satisfactory, and we congratulate them. Their foreign sales are rapidly extending to all parts of the world.

LOSS OF HEAT BY UNPROTECTED STEAM PIPES.

Mr. Albert Haacke, of the Kieselguhr Co., has recently fitted up an apparatus for measuring the amount of heat lost by radiation and convection from steam pipes and the like, and has communicated the result of some of his first experiments with it to *Engineering*, together with a description of the arrangement. The tests in question were directed to determine the relative losses of heat from (1) bare pipes; (2) pipes covered with 1 inch of fossil meal composition; and (3) pipes covered with 1 inch of fossil meal composition and three layers of hair felt. The testing surfaces are represented in Mr. Haacke's arrangement by three cast iron steam pipes of 5 inches internal diameter and 6 feet long with blank flanges on each end. These test pipes are supplied with steam that has been dried, and are placed so as to be subject to radiation and convection under precisely similar conditions, one being bare, the other covered with fossil meal composition 1 inch thick, the third with 1 inch of composition and three layers of No. 3 felt, each ½ inch in thickness. The result of experiments with steam in the different pipes under pressures of from 45 to 60 lbs. and upward, goes to show that a covering of fossil meal composition 1 inch thick saves out of a possible loss of 100 per cent. as much as 83.57 per cent.; and if over this covering 1½ inches of hair felt with canvas is added, the extra saving is only 8.25 per cent. If 1 lb of steam coal is required to evaporate 8 lbs. of water into steam of 60 lbs. pressure, then 6½ cwt. of steam coal are required every year to make good the loss of heat from every square foot of uncovered steam pipe. This loss is even greater in Winter, or when the pipes are exposed to wind and rain, or where steam of high temperature is used. Finally, Mr. Haacke combats the opinion which is firmly established in the minds of many users of steam, that the outside temperature of a non-conducting composition, applied to hot surfaces, is a measure of its non conducting efficiency. He considers this test of measuring the outside temperature, either by the hand or even by thermometer readings, as unreliable and misleading; and insists upon condensation experiments as the most reliable method of ascertaining the loss of heat by steam.—[Stationary Engineer.

Generation of Electricity Direct from Coal.

Prof. John Perry, F. R. S., in a recent address in England, said: "Now, I pointed out in 1881 that if coal or gas were burnt in a voltaic cell, as zinc is burnt, and an electro-motor were used, we could utilize as mechanical energy not merely one-tenth, but nearly nine-tenths of the energy of coal. I pointed out then that coal gas could be burnt in this way, but there were two difficulties: First, the apparatus required was too large per horse-power developed. Second, the apparatus required was too expensive. The first of these difficulties has already been got over by a correspondent, who is in some sense my partner. We see our way to developing one useful horse-power per cubic foot of volume of apparatus. Unfortunately, the difficulty of expense still remains. But I am firmly convinced, and I have good reason for my belief, that all the difficulties will be got rid of, and that coal will actually be burnt in this way. Even to those of you who may not be troubled about the general question of economy, the mere possibility of an armor-clad being able to carry enough coal for a voyage at full speed round the world, must appear to be an important result.

Low Rate Excursion.

The Nickel Plate will run another of those popular excursions to Chicago, on Tuesday, November 12th. Tickets good returning on any train leaving Chicago to and including Monday, November 18th. Rate for the round trip from Lorain, only $5, and corresponding low rates from all other stations. Visit the Live Stock Show.

Don't forget the Nickel Plate low rate Chicago Excursion on Tuesday, November 12th. Call on Nickel Plate ticket agents for particulars. Tickets good to return till November 18th, inclusive. Go see the Fat Stock Show.

THE STEEL FAMINE.

The recent rapid rise in the price of mild steel products promises to bear the usual fruit of new works. Projects are already budding in various quarters, some of which will undoutedly mature, although many of them may not advance beyond the first stage of discussion and the consideration of the several steel processes now in successful use. The very low price at which steel slabs and billets were sold early in the present year induced an increased number of rolling-mill operators to purchase steel for their use, as they could then sell some forms of their product as cheap when rolled from steel as iron. But steel is now parting company with iron, steel slabs and billets are hard to get even at the advance, and embarrassment is caused by the necessarry return of these manufacturers to iron. Consumers have been educated to expect a better quality, owing to the substitution of steel for iron, and will probably complain of what they will allege is an attempt on the part of manufacturers to foist an inferior material on them. This is especially the case in the sheet-iron trade. Consumers of sheet-iron have been getting sheet-steel at sheet iron prices, and crediting the manufacturers with improving the quality of there iron without knowing that they were getting steel. The enforced change to iron will undoubtedly breed dissatisfaction. Sheet manufacturers cannot remedy this state of affairs immediately, because they are unable to purchase steel slabs. They will be forced to put up their own steel-works, and those having the necessary capital within their reach are understood to be forming plans to this end as rapidly as possible. It is quite likely that in the near future one and perhaps more large steel-works will be built by associated iron-rolling mills to supply themselves with steel, which is now an indispensable material to them. They do not propose to be caught again by a sudden increase in the demand for steel. This means, of course, a more rapid substitution of steel for iron than ever after such new steel-works get into operation.—[Metal Worker.

Hollow Cast Iron Bricks.

Hollow, cast iron bricks, if we may so term them, says the *Engineering and Building Record*, form the subject of a recent German patent granted to August Bockel, of Erfurt. As the name implies, they are made of regular brick form and size, the walls being 0.12 inches thick. No mortar or other binding material is to enter in their use, the fastening being effected as follows: The upper and lower sides of the bricks are provided with grooves and projecting ribs which fit into one another. There are, further, two large circular openings in the upper side of each brick arranged to receive properly formed projections on the lower side of the brick above. One of these projections is nook shaped, so as to give a more secure hold. A fluid is applied to the surfaces of the bricks with a brush, to make the joints air and water-tight. The non conducting air spaces in the bricks, and the ease with which they may be put together and taken apart without injuring them, are cited as special advantages. The question of cost is not considered.

To Those Looking

—FOR—

Manufacturing SITES

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THE MOST DESIRABLE LOCATIONS IN THE SOUTH for manufacturing wagons, stoves, agricultural implements, furniture, or for foundries, machine shops, rolling mills and nail works, glass works, cotton or woolen mills, are to be FOUND IN VIRGINIA along the line of the Norfolk & Western Railroad from Norfolk to Bristol and upon its branch lines. HARD WOOD OF EVERY VARIETY; CHEAP IRON from the furnaces at Lynchburg, Roanoke, Radford (to be built in 1889), Pulaski and Ivanhoe; CHEAP COAL AND COKE **from the celebrated Pocahontas Flat Top Field**; GLASS SAND from Tazewell Co.; COTTON FROM THE MARKETS of the Southern States, and Wool from all the Western and Southwestern States and Territories, at advantageous freight rates. FAVORABLE FREIGHT RATES made upon raw materials to all factories established upon its line, as well as to points in the United States and Territories, upon the manufactured articles.

Those seeking new fields for manufacturing establishments should not fail to investigate **the wonderful development in Iron, Coal and Coke Industries that has been made within the past five years along the line of the Norfolk & Western Railroad, and the advantages offered by the State of Virginia in the supply of cheap raw materials, by the Norfolk & Western Railroad** in the matter of freight facilities and rates upon raw materials and for reaching home, far distant and foreign markets, and by the cities and towns along its line in the way of advantageous sites, at moderate cost. Many of the cities and towns exempt manufacturing establishments from taxation for a series of years.

For further information as to freight rates and sources of supply of raw materials, apply to A. POPE, General Freight Agent, Roanoke, Va., or to

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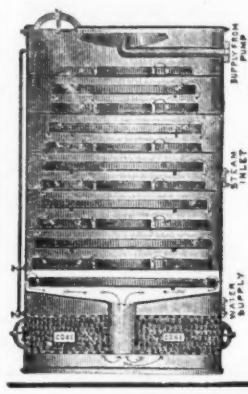

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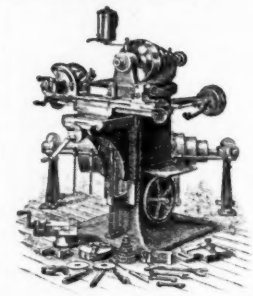

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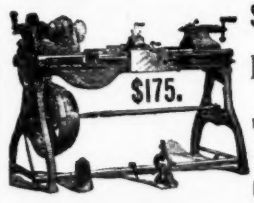

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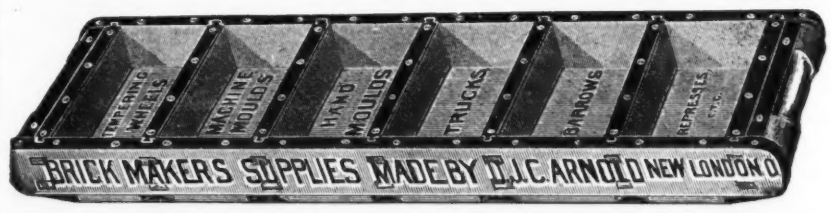

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Not affected by wind or rain, producing a large, brilliant, white flame, and lighting for one cent per hour.

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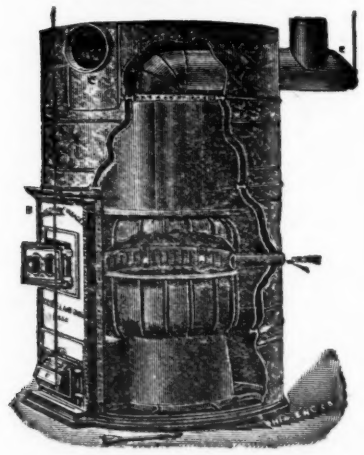
Burns Hard Coal, Soft Coal, Coke or Natural Gas.



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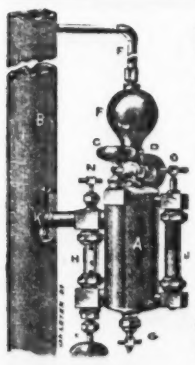

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Office and Warerooms, 28 Columbus st. Factories on Columbus, Winter and Leonard streets.

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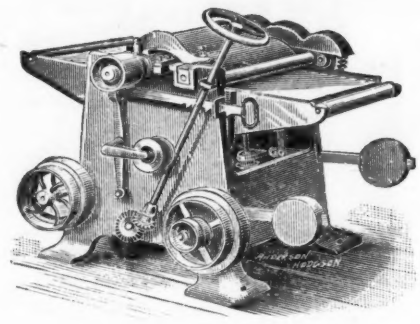

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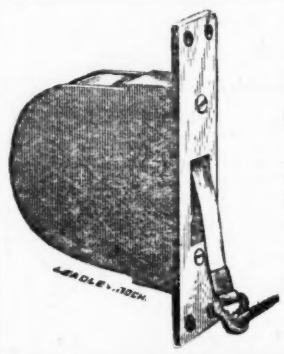

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It is cheap, easily applied, and gives perfect satisfaction. Adapted to old and new windows, and does not require box frames. Does not get out of order and is a PERMANENT FIXTURE.

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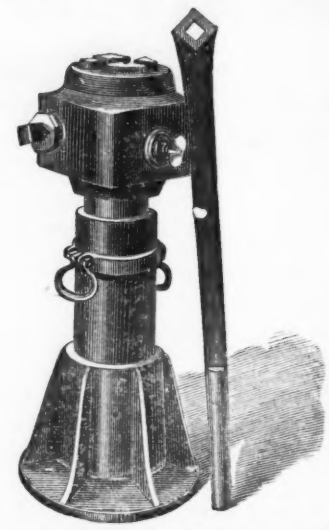

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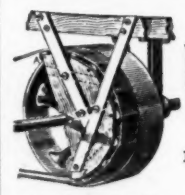

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PIG IRON.

CLEVELAND (f. o. b. cars, four months): Bessemer, $19 00@19 50; No. 1 Foundry, $18 15@18 65; No. 2 Foundry, $17 15@17 65; No. 1 Gray Forge, red short, $16 65@17 25; No. 2 Gray Forge, neutral, $16 15@16 65; No. 1 American Scotch, $19 40@20 05; No. 2 American Scotch, $18 40@19 05.

CHICAGO (reported by Rogers, Brown & Co.): Southern Coke No. 1 Foundry, $17 50@00 00; Southern Coke No. 2 Foundry, $17 00@00 00; Southern Coke No. 3 Foundry $16 50@ 0 00; Southern Coke No 1 Soft, $ 7 00@00 00; Southern Coke No. 2 Soft, $16 7 @ 0 00; Southern Grey Forge, $16 25@16 50; Ohio Silveries No. 1, $18 25@1 5 ; Ohio Silveries No. 2, $17 25@17 5 ; Ohio Strong Softeners No. 1, $18 75@19 00; Ohio Strong Softener No. 2, $ 7 7 @18 00; Lake Superior Charcoal Nos. 1 to 6, $20 0 @20 50; Tennessee Charcoal No. 1, $19 50@00 0 ; Tennessee Charcoal No 2, $ 8 50@0 00; Southern Standard Car Wheel, $24 0 @00 00; Tennessee Standard Car Wheel, $19 0 @ 0 00, Hanging Rock Standard Car Wheel Cold Blast, $26 0 @28 00; Hanging Rock Standard Car Wheel Warm Blast, $22 0 @24 00.

CINCINNATI (reported by Rogers, Brown & Co.): HOT BLAST FOUNDRY—Ohio and SouthernCoke No. 1, $16 25@16 75; Ohio and Southern Coke No. 2, $15 75@16 25; Ohio and Southern Coke No. 3, $15 25@15 50; Ohio Soft Stone Coal No. 1, $17 00@17 50; Ohio Soft Stone Coal No. 2, $ 6 00@16 50; Hanging Rock Charcoal No. 1, $20 00@22 00; Hanging Rock Charcoal No. 2, $19 00@21 50; Tennessee and Alabamba Charcoal No. 1, $18 00@18 50; Tennessee and Alabama Charcoal No. 2, $17 00@17 50. FORGE—Strong Neutral Coke, $15 25@15 50; Mottled Neutral Coke, $14 50@14 75; Cold Short Coke, $15 00@00 00. CAR WHEEL AND MALLEABLE—Southern Car Wheel, $23 00@24 00; Hanging Rock Cold Blast, $22 00@25 00; Lake Superior Malleable and Car Wheel, $20 00@21 00.

LOUISVILLE (reported by Geo. H. Hull & Co.): Southern Coke No. 1 Foundry (new classification), $15 75@16 25; Southern Coke No. 2 Foundry (new classification), $15 25@15 75; Southern Coke No. 3 Foundry (new classification), $15 00@15 50; Grey Forge, $14 00@14 25; White and Mottled, different grades, $14 00@14 25; Silver Grey, different grades, $14 50@15 50; Southern Charcoal No. 1 Foundry, $17 25@17 75; Southern Charcoal No. 1 Mill, $15 75@16 25; Southern Car Wheel, Standard Brands, $23 00@24 00; Southern Car Wheel, other brands, $18 75@21 25; Hanging Rock Coke No. 1 Foundry, $17 00@17 50; Hanging Rock Charcoal No. 1 Foundry, $21 50@22 00; Hanging Rock Cold Blast, $23 50@25 50; Hanging Rock Warm Blast, $00 00@00 00.

LOUISVILLE (reported by Hall Bros. & Co.): HOT BLAST FOUNDRY—Southern coke No. 1, $16 00@16 50; Southern coke No. 2, $15 50@15 75; Southern coke No. 3, $15 25@15 50; Mahoning Valley (Lake ore mixtures), $19 00@19 50; Southern charcoal, No. 1, $18 00@18 50; Southern charcoal, No 2, $17 50@18 00; Missouri charcoal, No 1, $19 00@19 50; Missouri charcoal, No. 2, $18 50@1 00 FORGE—Neutral coke, $15 00@15 25; Cold short, $15 00@15 25; Mottled, $14 00@14 50. CAR WHEEL AND MALLEABLE—Southern (standard brands), $23 00@23 75; Southern (other brands), $19 00@19 50; Lake Superior, $22 00@22 50.

ST. LOUIS (reported by Rogers, Meacham & Shields): HOT BLAST COKE AND CHARCOAL—Southern Coke No. 1, $16 50@17 00; Southern Coke No. 2, $16 25@16 50; Southern Coke No. 3, $00 00@15 75; Southern Grey Forge, $00 00@15 75; Southern Charcoal No. 1, $18 50@19 00; Southern Charcoal No. 2, $17 50@18 00; Missouri Charcoal No. 1, $18 00@18 50; Missouri Charcoal No. 2, $17 00@17 50; Ohio Softeners, $18 50@20 00. CAR WHEEL AND MALLEABLE IRONS—Lake Superior, $21 50@22 50; Southern, $19 00@24 00. CONNELLSVILLE COKE—East St. Louis, $5 25; St. Louis, $5 40.

BUFFALO (reported by Rogers, Brown & Co.): Mahoning and Shenango Valley strong, No. 1 Foundry, $19 0@00 00; Mahoning and Shenango Valley strong, No. 2 Foundry, $18 00@00 00; Niagara No. 1, $19 00@00 00; Niagara No. 2, $18 00@00 00; Niagara No. 3, $17 25@00 00; Ohio Softener No. 1, $ 9 25@ 0 00; Ohio Sofener No. 2, $18 25@00 00; Lake Superior Charcoal, $21 00@00 00; Tennessee Charcoal, $19 50@20 50; Southern Softener No. 1, $18 25@00 00; Southern Softener No 2, $17 50@00 00; Alabama Car Wheel, $25 00@25 25; Hanging Rock Charcoal, $24 00@00 00.

DETROIT (reported by William F. Jarvis & Co.): Lake Superior Charcoal, all Numbers, $20 00@20 50; Lake Superior Charcoal, Bessemer, $20 50@2 00; Lake superior Coke, all Ore $ 9 75@20 25; Lake Superior Coke, Cinder Mixed, $18 25@18 75; Standard Ohio Black Band, $19 75@20 2 ; Southern No. 1, $18 25@18 50; Southern Gray Forge, $16 25@16 50; Southern Silvery, $16 50@17 00; Jackson County (Ohio) Silvery, $19 25@19 75; Old Wheels, $19 00@19 75; Old Iron Rails, 25 00@25 50.

PITTSBURGH (reported by A. H. Childs): No. 1 Foundry, $18 50@18 75; No. 2 Foundry, $17 50@17 75; Grey Forge, $16 75@17 00; White and Mottled, $15 50@15 75; Warm Blast Charcoal, $18 00@22 00; Cold Blast Charcoal, $24 00@28 00; Bessemer, $20 00@21 00.

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Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 80
4¼ to 6 by ⅜ to 1 inch	1 90
1½ to 6 by 1⅛ to 2 inch	2 20
1¼ & 1⅜ by ⅜ to ¾ inch	1 00
1 & 1¼ by ⅜ to ¾ inch	1 90
⅝, ¼ and ⅞ by ⅜ to ⅝ inch	2 30

Round and Square.

1 to 1⅞ inch	1 80
2 to 2⅝ inch	2 00
2¾ to 3¼ inch	2 30
3⅜ to 4 inch	2 80
4¼ to 4½ inch	3 30
4¾ to 5 inch	3 50

Oval.

⅞ to 1¼ inch	2 20
⅝ to ¾ inch	2 40
½	2 60
⅜	3 00

Half Oval and Half Round.

1½ to 3 inch	2 90
⅞ to 1¼ inch	2 50
⅝ to ¾ inch	3 00
½	3 30
⅜	4 80

Heavy Band.

½ to 6 by ¼ and 5-16 inch	1 95
to 1⅜ by ¼ and 5-16 inch	2 05
¾ to ⅞ by ¼ and 5-16 inch	2 25
½ to ⅝ by ¼ and 5-16 inch	2 75

Hoops.

1¼ to 4, Nos. 13 to 15	2 65
1¼ to 2, Nos. 16 to 18	2 75
1¼ to 2, No. 19	2 85
1¼ to 2, No. 20	2 95
1¼ to 2, No. 21	3 05
1¼ to 2, No. 22	3 15
15-16, 1 and 1⅛, Nos. 13 to 15	2 85
15-16, 1 and 1⅛, Nos. 16 to 18	2 95
15-16, 1 and 1⅛, Nos. 19 and 20	3 05
15-16, 1 and 1⅛, No. 21	3 15
15-16, 1 and 1⅛, No. 22	3 35
⅞, Nos. 13 to 15	2 05
⅞, Nos. 16 to 18	2 15
⅞, Nos. 19 and 20	2 25
⅞, No. 21	3 35
⅞, No. 22	3 45
13-16, Nos. 13 to 15	3 25
13-16, Nos. 16 to 18	3 35
13-16, Nos. 19 and 20	3 45
13-16, No. 21	3 55
13-16, No. 22	3 65
¾, Nos. 13 to 15	3 35
¾, Nos. 16 to 18	3 45
¾, Nos. 19 and 20	3 55
¾, No. 21	3 65
¾, No. 22	3 75
11-16, Nos. 13 to 15	3 55
11-16, Nos. 16 to 18	3 65
11-16, Nos. 19 and 20	3 75
11-16, No. 21	3 85
11-16, No. 22	3 95
⅝, Nos. 13 to 15	4 05
⅝, Nos 16 to 18	3 85
⅝, Nos. 19 and 20	4 05
⅝, No. 21	4 15
⅝, No. 22	4 25
⅝, No. 23	4 35

Light Band.

1½ to 6 by ⅛ to 3-16 in	2 25
1½ to 6 by Nos. 11 and 12	2 35
1 to 1⅜ by ⅛ to 3-16 in	2 35
1 to 1⅜ by Nos. 11 and 12	2 45
⅞ and 13-16 by ⅛ to 3-16 in	2 65
⅞ and 13-16 by Nos. 11 and 12	2 75
¾ and 11-16 by ⅛ to 3-16 in	2 95
¾ and 11-16 by Nos. 11 and 12	3 05
⅝ and 9-16 by ⅛ to 3-16 in.	3 25
⅝ and 9-16 by Nos. 11 and 12	3 30
½ by ⅜ to 3-16 in	3 50
½ by Nos. 11 and 12	3 60

Wagon Box Iron.

⅞ inch, beveled edge, by Nos.				11 and 12 2 75
⅞ inch,	"	"	"	13 and 14 3 05
¾ inch,	"	"	"	11 and 12 3 05
¾ inch,	"	"	"	13 and 14 3 25

Sheet Iron.

No. 10 to 14	2 60
No. 15 to 17	2 80
No. 18 to 21	2 90
No. 22 to 24	3 00
No. 25 to 26	3 10
No. 27	3 20
No. 28	3 40

Iron Boiler Plates.

Tank, ¼ inch and heavier			2 40
C No. 1,	"	"	2 65
C H No. 1	"	"	2 90
C H Flange,	"	"	3 60
Extra Flange,		"	4 00
Solid Fire Box,		"	4 90

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 65
Shell	3 05
Flange	3 30
Marine Flange	3 80
Fire Box	4 45

Above includes plates 90 inches wide.

90 to 96 in. wide	½c lb extra
96 to 100 in. wide	1 c "
100 to 104 in. wide	1½c "
104 to 116 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. lbs
1 to 2 in. inclusive	09
9-16 to ½ in "	09
7-16 to ⅜ and 2⅜ to 3 in	10½
3⅛ to 4 in	11
⅝ to 11-16 and 4⅛	10½
⅛ to 6 in	11½
¼ to 9-32 and 6⅛ to 7 in	12
3-6 in	14

Flats.

	cts. lbs
2 to 9-16 wide by 2 to ⅝ thick	0

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		ct. lb
Machinery	base price,	02¾
Tire	"	02¼
Spring	"	03¼
Sleigh Shoe	"	02¾
Toe Calk	"	03
Cutter Shoes, tapered and burr.	"	03

English Tool Steel.

Jessop's	16c
Hobson's "Best"	16c
" "Choice"	36c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	4 00
Bridge ½, ⅝, 11-16 and ¾ inch diam	4 00

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	NET TONS
No. 1 R. R. wrought scrap	$20 50
No. 1 wrought scrap	19 00
No. 1 Machine cast scrap	13 00
Pipes and Flues (clean)	23 00
Iron axles	24 00
Axle turnings	14 50
Wrought turning (free from cast)	13 00
Cast borings	9 00
Uncut wrought iron boilers	12 00
Steel boiler plates	13 00
Grate Bars	8 50
Pipes and flues (Clean)	12 75
Tank iron	12 50
Hoop and band iron	9 50
Sheet iron	8 00
Wrought drillings	11 00
Malleable iron	9 50
	GROSS TONS
Old iron T rails	24 00
Old steel rails	18 00
Old car wheels	17 00
Old copper	₩ lb 10
No. 1 H. red Brass	11
Heavy yellow brass	8½
Light yellow brass	6
Scrap Zinc	
Tea Lead	
Heavy Lead	3¼

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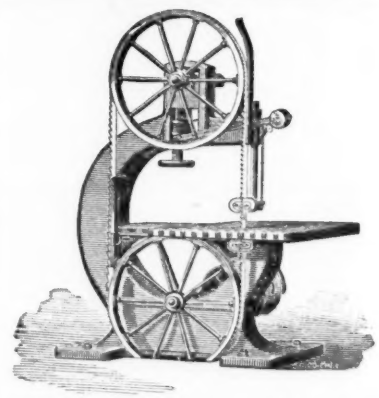

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$185 will buy our new patent band re-sawing machine.

$100 will buy the best No. 1 automatic rip-sawing machine. Weatherboarding attachment included, and one 12-inch rip saw.

$125 our new No. 2 complete as above.

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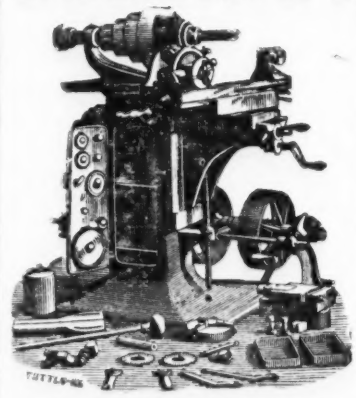

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Gear and Rack Cutting, Milling and Index Drilling to Order.

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MACHINERY SUPPLY MARKET.

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American.....₩ lb 9@10
Wrights.....₩ lb 9½

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Blacksmiths' { Hill's.....dis 40 / Bullock's.... dis 50&10
Moulders'.....dis 40@40&10
Hand.....dis 40&10@50

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Boston Belting Co's standard.....dis 70@70& 5
" " " extra.....dis 60&5@60&10
" " " best.....dis 55
Hoyt's Short Lap.....dis 45
Cleveland Rubber Co. extra standard.dis 60&10
Shultz Raw Hide Leather Belting, single.....dis 35&5
Shultz Raw Hide Leather Belting, double, and Light Double.....dis 35&5
Standard, oak tanned.....dis 55@60
Alexander Brothers' pure oak tanned.....dis 45

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B. F. Sturtevant's.....dis 20
Boston Blower Co.,.....dis 35
Buffalo.....dis 35

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.....₩ lb 9½@10½

Chalk.

White.....₩ gross 50
White Crayon.....₩ gross 12@12½ dis 10
Red.....dis 70
Blue.....dis 85

Chucks.

Cushman's 4 Jaw Independent.....dis 45
" Combination.....dis 40
" Geared Scroll.....dis 30
" 2 Jaw Brass Workers.....dis 25
" Drill.....dis 35
Wescott's Scroll Combination.....dis 30
" Independent.....dis 40
" Little Grant Drill.....dis 30
Horton's Universal & Ind.....dis 40
National Combination.....dis 40
Sweetland " .....dis 40
Skinner " .....dis 40
" Independent.....dis 40
Almond Drill.....dis 25
Morse " .....dis 15
Skinner " .....dis 30

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Cleveland.....dis 10@15
Pratt & Whitney.....dis 10@15
Standard.....dis 10@15
Brown & Sharpe, Milling Cutters.....dis 15
" " Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 4
Iron, steel points.....₩ lb 3½

Drill and Drill Stocks.

Twist drills.....dis 50&10
Morse Taper and Straight shank to 1½".....dis 50&10
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Standard.....dis 50&10
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Maneer's bench.....dis 50&25
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Emery.

	No. 4 to 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ₩ lb	4 c	5 c		2½c
½ kegs ₩ lb	4¼c	5¼c		2¾c
¼ kegs ₩ lb	4½c	5½c		3 c
10 lb cans, 10 in case	6 c	6½c		5 c
10 lb cans, less than 10	10 c	10 c		7½c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 40@46
H. H. Barton.....dis 40@46

Emery Wheels.

Detroit.....dis 50@60
Norton's.....dis 55@60
Grant.....dis 55@60
Union Stone.....dis 60
Sterling.....dis 60
Vulcanite.....dis 15@20
Celluloid.....dis 10
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60

Files.

Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
Arcade.....dis 65@70
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.

Jack Screws.

Illinois Bolt Co. list.....dis 70

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¼	4	3¼	3½
Hexagon	15½	11½	8½	6	5¼	5¼	5
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ₩ lb add ½c., 1lb boxes add 1c to list.

Nails (wire.)

List July 14, 1887.....dis 70 &10
Standard Penny Nails, ₩ keg card rate { Car lots.....$2.30 / Less than car lots $2.40

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 10@11
Russia Packing " .....₩ lb 14
Italian Packing " .....₩ lb 13@14
Plumbago Piston.....₩ lb 40
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 70
Sheet Rubber.....₩ lb 12@24
Excelsior Rubber.....₩ lb 48

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 45
Medart Pulleys.....dis 55
Split Wood Pulleys.....dis 45

Rivets.

Iron, Thousand, list November 17,.....dis 50
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50
Copper.....dis 50@50&10

Rope.

Manilla, ½ inch and over.....₩ lb 15¼
Sisal, ½ inch and over.....₩ lb 13¼

Sand Paper.

B. A. & Co.....dis 40@40&10
H. H. Barton's.....dis 40@40&10
New England Flint.....dis 40@40&10
Barton's Garnet.....dis 25

Saws.

Disston's Circular.....dis 45
" Band.....dis 20
" Scroll.....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Disston's.....dis 20
Atkins' Cicular Saws.....dis 50
" Mill, Mulay and Drag Saws..dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....dis 70c per '
" Dexter Cross-cuts.....dis 50c "
" Diamond " .....dis 30c "
" Tuttle Tooth Cross-cuts..dis 25c "
" One-man Cross-cuts.....dis 32c "
No. 1 Handles.....dis 23c per pair
No. 6 " .....dis 16c "
Excelsior Saw Tools.....$6 per doz
Perfection " .....$15 "
Detroit Saw Works, Circular.....dis 50
" " " Band.....dis 25
" " " Mulay.....dis 45

Screws.

Wood Screws—List Jan 27, 1889.

Flat head iron.....dis 50
Round head iron.....dis 40
Flat head brass.....dis 45
Round head brass.....dis 35
Square Cap.....dis 65
Hexagon Cap.....dis 60
Set C. H. C. P.....dis 70
Machine, flat head, iron.....dis 55
Machine, round head, iron.....dis 50
Bench and hand—
Lag or coach.....dis 75@75&10
Coach, patent gimlet point.....dis 75

Shovels and Spades.

Ames' list November 1, 1885.....dis 20
Dennis.....dis 5.25
Hussey & Binns, railroad.....dis 8.00

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 50
Pulley Taps.....dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ½ lb Balls	21C@29c	
No. 18 " " ¼ and ½ "	18c@28c	
No. 36 " " ¼ and ½ "	16c@27c	
2-Ply Hemp, ¼ & ½ lb Balls	Spring Twine	11½c
3-Ply " 1lb Balls	12@12¼c	
3-Ply " 1½ lb Balls	11@11¼c	

Cotton Wrapping, 5 Balls to lb.....15@16c

Vises.

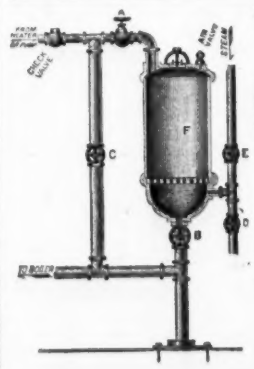
Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 10@15
Howard.....dis 30
Maneer's machinist.....dis 50&10

Wire.

	New List, Jan. 18, 1884
Brass and copper	dis 20@25
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis 65&5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	$6.00@lb dis 30

Wrenches.

Coe's genuine, cash in ten days.....dis 50
Girard Standard.....dis 70&10
Agricultural.....dis 75&10
Mechanics'.....dis 55&10,& 3
Bemis & Call's Combination.....dis 35
Donohue's Engineers.....dis 20&10
Lamson & Sessions Engineers.....dis 60
Billings & Spencer's Drop Forged.....dis 10
William's " " .....dis 10
Alligator " " .....dis 40



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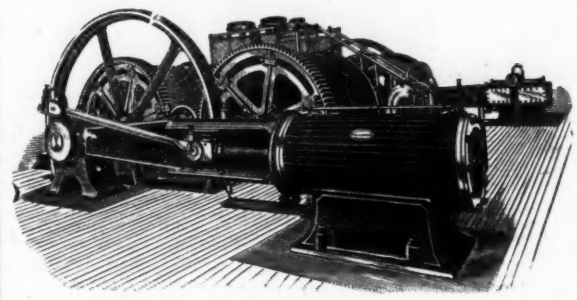

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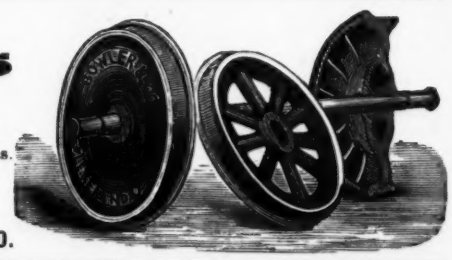

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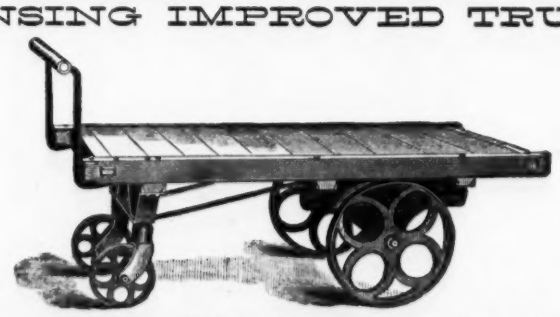

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nell's.....dis 60&5
Cook's Douglass Mfg. Co.....dis 55
Russell Jennings' augers and bits.....dis 25
Expansive Bits, Clark's small, $18; large, $26.....dis 35@35&5
Hollow Augers, Ives'.....dis 25&10
Hollow Augers, Bonney's Adjust. ₩ doz., $48.....dis 40&10
Hollow Augers, Stearns' Adjust. ₩ doz., $48.....dis 20&10
Gimlet bits, common.....per gross $2 75@3 25
Standard Bit Stock Drills.....dis 50&10&5
Ship Augers.....dis 15&10@15&10&5

Axes.

Makers' and Special Brands—
First quality.....₩dox. $6 25@6 75
Others.....₩doz. $5 75@6 00
Full polished.....$8 25

Bolts.

Cast iron barrel bolts.....dis 70@70&10
Cast iron shutter bolts, etc.....dis 70@70&10
Cast iron chain bolts.....dis 65&10
Ives' patent door bolt.....dis 60
Wrought iron barrel bolts.....dis 70@70&10
Wrought iron square bolts.....dis 70@70&10
Wrought shutter bolts.....dis 60&10

Sargent's list
Carriage, common, new list.....dis 75&7½
Tire, common, new list.....dis 70
Carriage and tire, Philadelphia pattern.....dis 75&10
Stove bolts.....dis 62½
Plow bolts.....dis 60&5
Machine.....dis 75&10@80
Ends.....dis 75&10&80

Buckets, Elevator.

.....dis 50&10

Butts.

Wrought brass.....dis 80
Cast brass, loose joint.....dis 33⅓&10
Cast Iron—
Fast joint, narrow.....dis 50&10&5@60&5
Fast joint, broad.....dis 55&10&5@60&10
Loose joint.....dis 70&10@75
Loose joint, jap.....dis 70&10@75
Loose joint, jap. with acorns.....dis 70&10@75
Loose pin, acorns.....dis 70&10@75
Loose pin, japanned acorns.....dis 70&10@75
Loose pin, acorns, jap. plated tips..dis 70&10@75
Wrought steel—
Wrought, fast joint, narrow.....dis 70&10@75
Wrought, fast joint, broad.....dis 70&10@75
Wrought, loose joint, broad.....dis 70&10@75
Table Butts, back flaps, etc.....dis 70&10@75
Regular inside blind.....dis 70&10@75
Light inside blind.....dis 70&10@75
Loose pin.....dis 70&10@75
Light loose pin.....dis 70&10@75

Chains.

Trace, 6½-10-2.....₩ pair 1.03
Trace, 6½-10-3.....₩ pair .92 } 50&10@50&10&5
Trace, 7-10-2.....₩ pair 1.11
German Halter Chain, list June, 1887...dis 50&10
German Coil, list of June, 1887..dis 50&10&5@60
Galvanized Pump Chain.....₩ lb 5½@6
Jack Chain, Iron.....dis 75@75&5
Jack Chain, Brass.....dis 70@70&5

Chisels.

Socket Framing and Firmer.....dis 75&5@75&10
Socket Framing and Firmer, Buck Bros..dis 30
Socket Firmer and Framing, L. & I. J. White.....dis 30@30&5
Tanged Firmers.....dis 40&10

Cutlery.

Table.....net
Excelsior Pocket.....net

Gimlets.

Nail and Spike.....dis 50&10&5
Double cut, low list.....dis 25
"Bee".....₩ gross $12, dis 25@25&5

Haugers.

Barn door, old patterns.....dis 10&10@70
Climax, (Anti-Friction).....dis 70
Star.....dis 40&10@40&10&5
Scranton.....dis 40
Kidder's.....dis 50&10@60
Terry's Patent.....5 in., $12; 4 in., $10, dis 50&5
Paragon.....dis 40&10
Richard's.....dis 30@30&10

Horse Nails.

	No. 10	9	8	7	6	
Ausable, ₩ lb.	23	24	25	26	28	dis 25&10@25&10&10
Putnam, ₩ lb.	18	19	20	21	23	dis 15
Essex						dis 25&10@25&10&10

Horse Shoes.

Burden, at factory.....₩ keg $4 00
R. I. Horshoe Co., Perkins' Imp. at factory.....₩ keg $4 00
Mule Shoes, at factory.....₩ keg $5 00

Knobs.

Carriage, japanned.....₩ gross 80c dis 60&10
Base, rubber tip.....dis 70&10&5
Hemacite door knobs, new list.....dis 40&10@50
Door mineral.....dis 65c@68c
Door Por. japanned.....dis 75c@78c
Door Por. nickle.....$2 00@2 25
Door Por. plated.....$2 00@2 25

Locks, Bolts, Etc.

P. & F. Corbear, Locks and Bronze Goods.
Door locks, knobs and latches.....dis 60
Escutcheons and keys.....dis 60
Padlocks and padlock keys.....dis 66⅔
Bell pulls, mineral, porcelain and jet.....dis 60
Bell pulls, genuine bronze.....dis 60&10
Lever bell pulls, genuine bronze.....dis 60&10
Butts', genuine bronze.....dis 60&10
Butts' bronze plated.....dis 60&10
Store door locks and latches.....dis 60&10
Store door handles.....dis 60&10
Shutter hinges&flaps, genuine bronze.dis 60&10
Shutter hinges, bronze plated.....dis 70
Flush bolts, genuine bronze.....dis 70
Shutter knobs, genuine bronze.....dis 50
Shutter bars, genuine bronze.....dis 60
Sash lifts, genuine bronze.....dis 60
Sash pulls and plates, genuine bronze.....dis 60
Push plates, genuine bronze.....dis 60
Drawer pull, genuine bronze.....dis 66⅔
Letter box plates, genuine bronze....dis 60&10
Barn door locks.....dis 33⅓

Plumbs and Levels.

Standard list.....dis 70&10@70&10&10
Pocket levels.....dis 70&10@70&10&10
Davis' inclinometers.....dis 10&10

Pumps.

Cistern, best makers.....dis 50&10@00
Pitcher spout, best makers dis 60&10@60&10&10
Pitcher spout, cheaper goods dis 70&5@70&10&5

Pokes, Animal.

Bishop's I. X. L.....₩ doz $6 50
Bishop's O K.....₩ doz $5 50
Bishop's Pioneer.....₩ doz $3 75
Bishop's American.....₩ doz $3 00

Rakes.

Cast steel.....dis 65
Malleable.....dis 70@70&5

Razors.

J. R. Torrey Razor Co.....dis 20
Wostenholme & Butcher.....$10@4....dis 10
Rifle razor.....dis $9 50 net

Scales.

Hatch, Counter, No. 171.....₩ doz $21 00
Hatch, Tea, No. 161.....₩ dox $6 75@7 00
Chatillon's Grocers.....dis 50
Family Turnbulls.....dis 30@30&10
Scale Beams, List of January 12, 1882.....dis 50&10@50&10&4

Screw Drivers.

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Stanley R. & L. Co.'s Black Handles..dis 60&10
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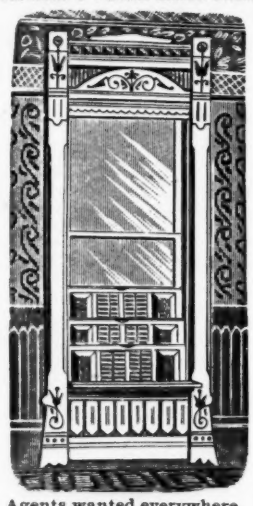
Squares.

Steel and iron, Nickel plated.....} dis 75&10@80
Disston's try square and T bevels.....dis 45&10
Winterbottom's try and miter.....dis 30&10

Tacks, Brads, Etc.

New List, January 2, 1888.
American iron carpet tacks all kinds.....dis 80@80&5
Steel carpet tacks all kinds.....dis 80@80&5
Swedes iron carpet tacks, all kinds.....dis 80@80&5
Swedes iron tacks.....dis 75&5@75&10
Swedes iron Upholsterers' tacks.....dis 75&10@75&10&5
Tinned Swedes iron tacks..dis 75&10@75&10&5
Tinned Swedes iron Upholsterers' tacks.....dis 75&10@75&10&5
American iron cut tacks.....dis 75@75&10
Copper tacks.....dis 50&10
Copper finishing and trunk nails.....dis 50&10
Cigar box nails.....dis 50&10@50&10&5
Finishing nails.....dis 70&10@70&10&10
Hungarian nails and miners' tacks.....dis 70&10@70&10&10
Gimp and lace tacks.....dis 75&10@75&10&5
" " " tinned.dis 75&10@75&10&5
Trunk and clout nails.....dis 70&10@70&10&10
Tinned trunk&clout nails.dis 70&10@70&10&10
Basket nails.....dis 70&10@70&10&10
Chair nails.....dis 70&10@70&10&10
Common and patent brads.dis 70&10@70&10&10
Tinned capped trunk n'ls..dis 70&10@70&10&10

Hartman's Patent Inside Sliding Window Blind



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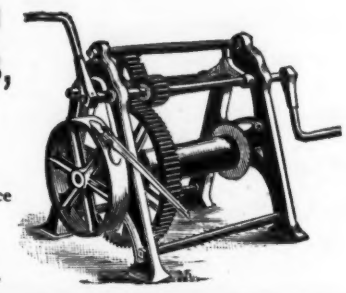

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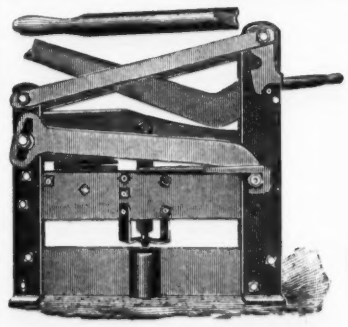

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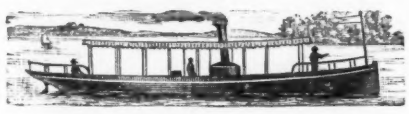

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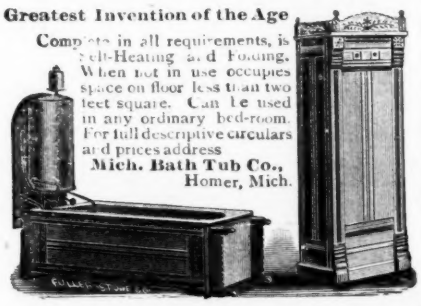

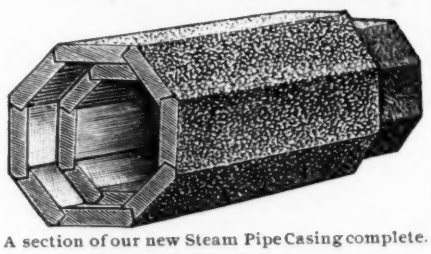

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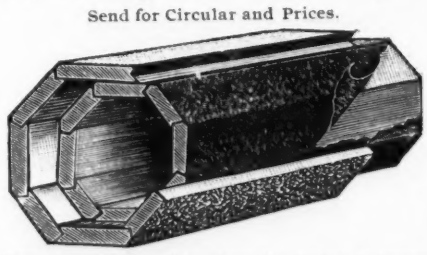

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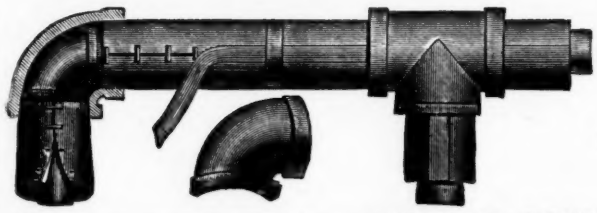

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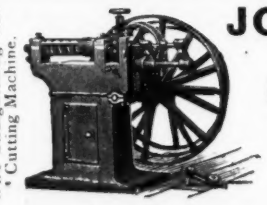

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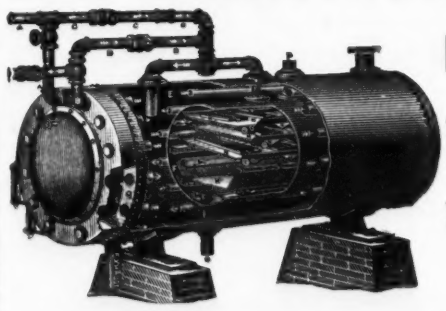

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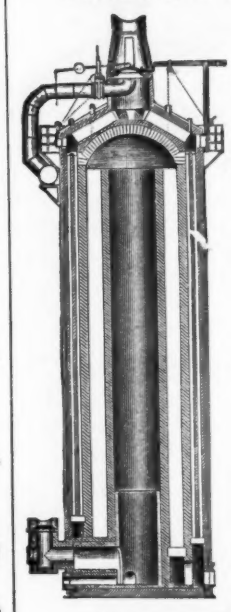

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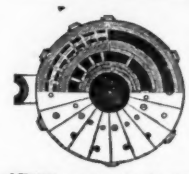

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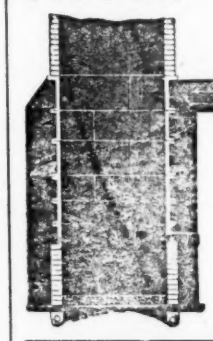

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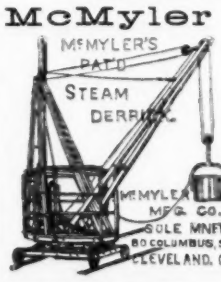

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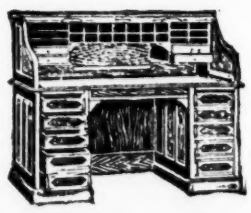

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FAST TIME. NO DELAYS.

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The people's favorite route I ween,
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TRAVELERS' REGISTER.

Standard Time.

Revised March 6th, 1888.

N. Y., C. & St. L. R. R. Co.—"The Nickel Plate."

Eastward.	Arrive.	Depart.
Buffalo Passenger.....	10 40 a m	10 45 a m
Chicago Passenger.....	9 20 p m	.....
Local Freight.....	4 30 p m	.....
Westward.	**Arrive.**	**Depart.**
Chicago Passenger.....		6.30 a m
Fostoria Passenger	5 06 p m	5 11 p m
Local Freight.....	1 00 p m	.....

Rocky River Accommodation departs 7:40 a. m.; 1:40 p. m.

Euclid Accommodation departs 6:20 a. m.; 4.55 p. m.

All trains daily, except Sunday.

Cleveland & Pittsburgh.

	Arrive.	Depart.
New York Express.....	12 50 p m	8 00 a m
New York Express.....	6 35 p m	1 05 p m
Alliance & Akron Accom.....	9 40 a m	3 25 p m
Ravenna Accommodation.....	8 25 a m	5 00 p m
Night Express.....	*5 25 a m	*11 10 p m

*Daily; all other trains daily, except Sunday.

Mt. Vernon & Pan Handle Route.

C., A. & C. Ry. Co.	Arrive.	Depart.
Akron, Col. & Cin. "Flyer"	5 40 p m	8 10 a m
Akron, Col. & Cin. Night Express.....	7 00 a m	8 00 p m
Akron, Col. & Zanesv'e Ex...	12 50 p m	1 05 p m
Akron & Orrville Accom.....	9 40 a m	3 25 p m

The 8 p. m. train runs daily. Elegant Pullman palace sleeping cars attached. All other trains daily, except Sunday.

Erie Railway.

Depot, South Water Street and Viaduct.

	Arrive.	Depart.
N. Y. & Pitts. Express.....	‡5 38 a m	*8 25 a m
Fast N. Y & Pitts. Express	*10 55 a m	*3 00 p m
Mahoning Accommo.....		†6 40 a m
Pittsburgh Express.....	†6 25 p m	
Youngstown Local.....	†8 05 a m	
Mahon'g div. & Pitts Local		*11 40 a m
Mahoning Val. Accom.....		†4 30 p m
Pittsburgh Express.....	†1 20 p m	11 10 p m
New York Express.....	*8 00 p m	.....

*Daily. †Daily, except Sunday. ‡Daily except Monday.

Cleveland & Canton Railroad.

(Standard Gauge.)

Depart for—

Zanesville and Coshocton—6:50 a. m., 3:00 p. m.
Canton 6:50 a. m., 3:00 p. m., 6:20 p. m.
Kent—6:50 a. m., 3:00 p. m., *5:45 p. m. 6:20 p. m.
Bedford—6:50 a. m., 11:10 a. m., 1:30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m. 10:35 p. m.
Newburgh—6:15 a. m., 6:50 a. m., 11:10 a. m., 1.30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m., 10:35 p. m.
Canton and intermediate stations (Sundays only), 8:00 a. m., 4:20 p. m.

Arrive from—

Zanesville and Coshocton—10:30 a. m., 6:30 p. m.
Canton, 10:30 a. m., 2:35 p. m., 6:30 p. m.
Kent—*8:10 a. m., 10:30 a. m., 2:35 p. m., 6:30 p. m.
Bedford—6:00 a. m., *8:10 a. m., 10:30 a. m., 1:05 p. m., 2 35 p. m., 4:15 p. m., 6:30 p. m., 7:10 p. m.
Newburgh—6:00 a. m., 7:15 a. m., *8:10 a. m., 10:30 a. m., 1.05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p. m., 7:10 p. m.
Canton and intermediate stations (Sundays only), 9:55 a. m., 6:30 p. m.
Trains marked * run daily.

Valley Railway.

FOR AKRON, CANTON AND MARIETTA.

Depot foot South Water Street.

	Depart.	Arrive.
Valley Junction Mail.....	*7 40 a m	*6 20 p m
Marietta Express.....	†11 15 a m	†2 20 p m
Valley Junction Express...	*4 15 p m	*10 15 a m
Cleve. and Canton Express	*7 00 p m	†8 10 a m

*Daily. †Daily, except Sunday.

WM. THORNBURGH, Gen. Manager. R. A. CARRAN, Gen. Pass. Agt.

Cleveland, Lorain and Wheeling.

All trains arrive and leave the Union Depot as follows:

	Depart.	Arrive.
Wheeling Express.....	6 45 a m	6 55 p m
Uhrichsville Express.....	4 00 p m	9 20 a m

OSCAR TOWNSEND Gen. Mang'r.

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Direct route, Columbus, O., to Circleville, Chillicothe, Waverly, Portsmouth, Ironton and Ashland, Ky. Three trains daily except Sunday. Favorite route, North and West, making close connection at Ashland, Ky., with the Chesapeake & Ohio Ry., through the canons of New River, passing White Sulphur Springs and the many Summer resorts of the Alleghenies in Virginia.

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PICTURESQUE ROUTE
—TO—
New York, Boston and the East.

The shortest and quickest Route to Pittsburgh, Washington and Baltimore & the Southeast.

New Central Depot So. Water St. and Viaduct.

	Depart.
No. 62, Accommodation.....	† 6 05 a m
No. 72, New York Express.....	* 8 10 a m
No. 72, Fast Pittsburgh Express.....	* 8 10 a m
No. 64, Fast Pittsburgh Express.....	* 3 00 p m
No. 66, Mantua Accommo	* 4 20 p m
No. 68, New York Vestibule Limited.	* 8 25 p m
No. 70, Pittsburgh Local Express.....	*11 25 a m
No. 74, Jamest'n, Pitts. & Y'ngst'n Ex	† 4 20 p m
	Arrive.
No. 65, Fast New York Express.....	*10 05 a m
No. 61, N. Y. & Pittsburgh Express...	* 7 15 a m
No. 71, Youngstown Local.....	* 2 10 p m
No. 67, Pittsburgh Express.....	†12 30 p m
No. 63, New York Express.....	* 6 50 p m
No. 63, Pittsburgh Express.....	* 6 50 p m
No. 69, Pittsburgh Local Express.....	† 8 55 p m
No. 73, Mantua Accommo.....	* 7 20 p m

*Daily. †Daily, except Sunday.

Baggage checked through to all points East.

Through tickets and information regarding the route can be obtained at office, 141 Superior street, and at Depot N. Y., P. & O. Railroad, South Water street and Viaduct, Cleveland.

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L. P. FARMER, Gen. Pass. Agt., New York
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M. L. FOUTS, City Pass. and Ticket Agt., 141 Superior st., Weddell House, Cleveland, O.

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LEHIGH VALLEY

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Wheeling & Lake Erie Railway.

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—AND—

Bowerston, Pittsburgh, Marietta.

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BETWEEN

Toledo & Marietta

Through Sleepers Between

PITTSBURCH AND CHICACO.

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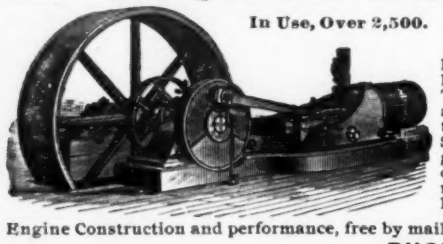

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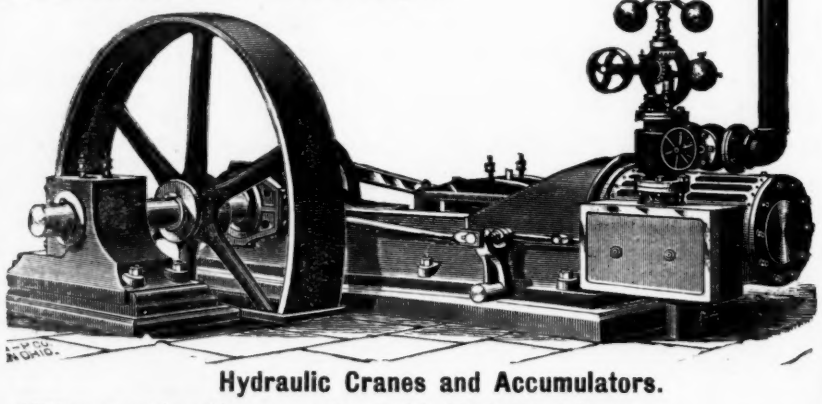

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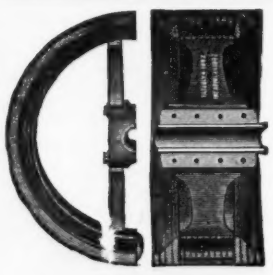

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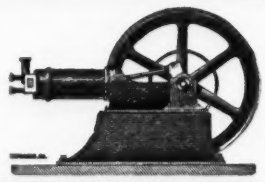

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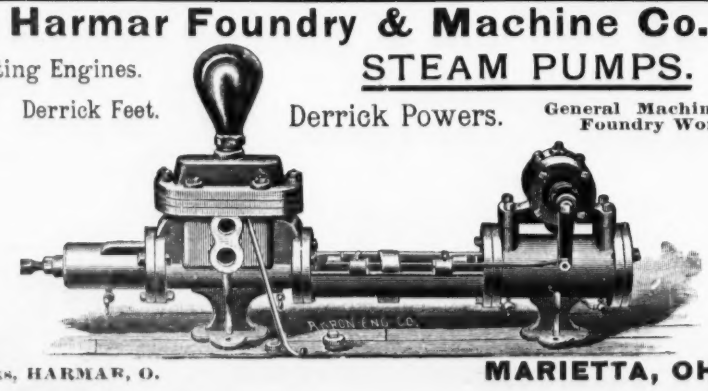

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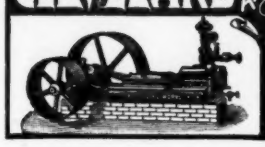

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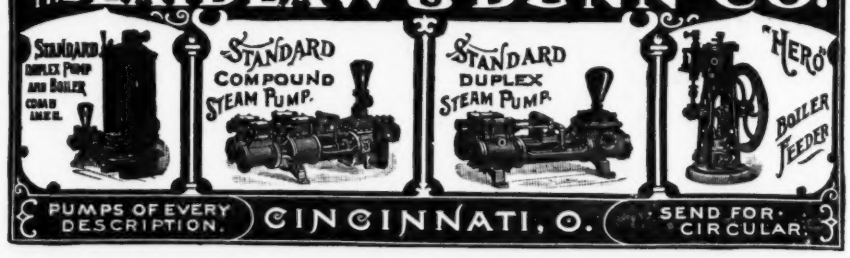

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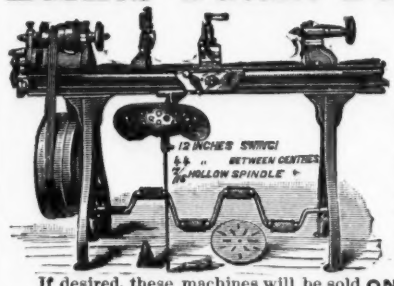

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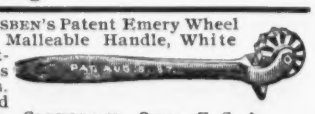

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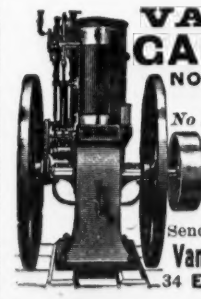

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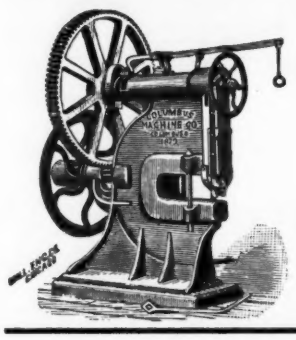

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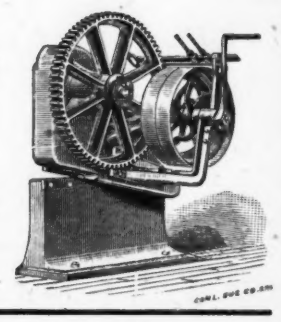

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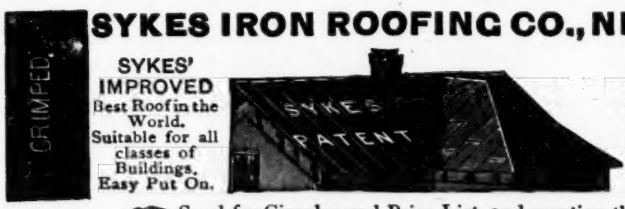
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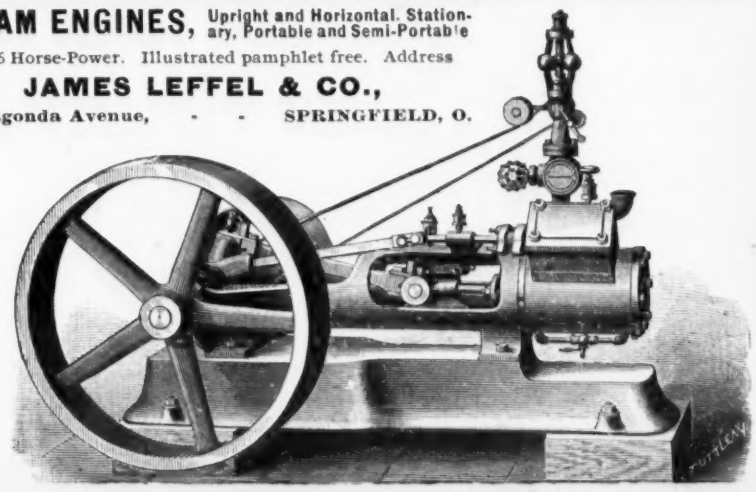

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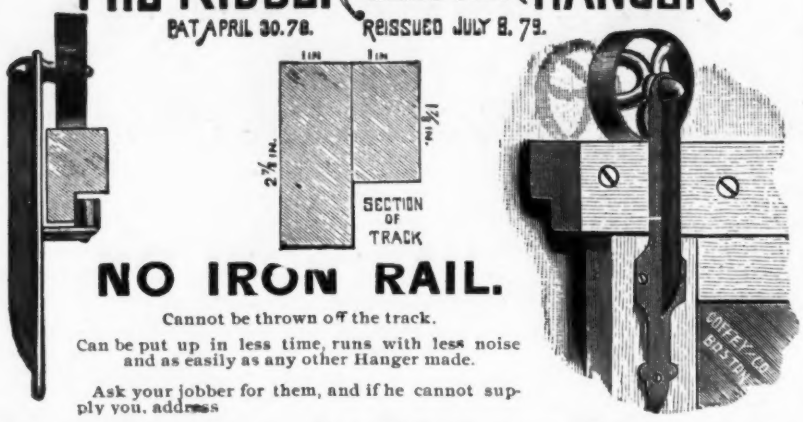

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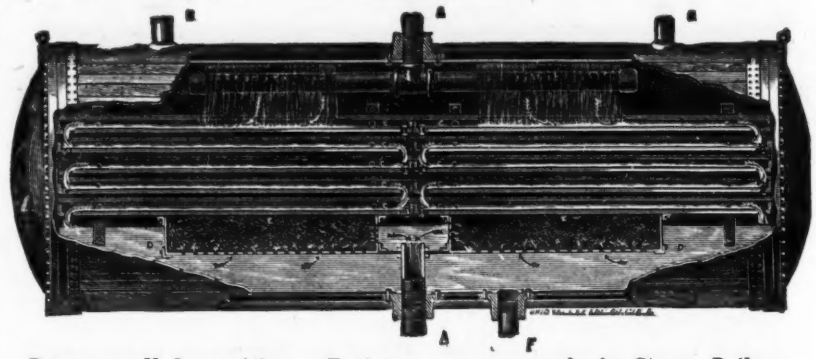

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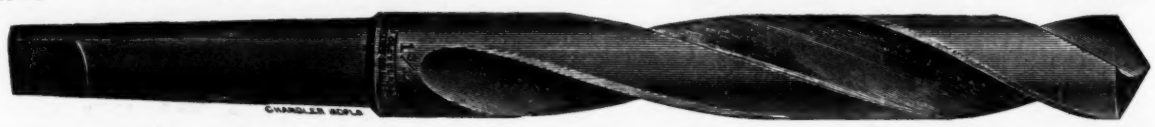

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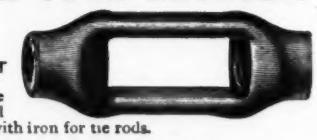

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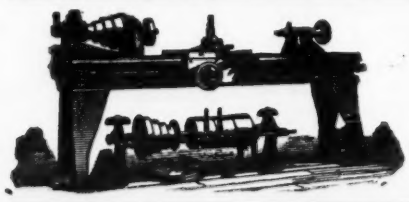

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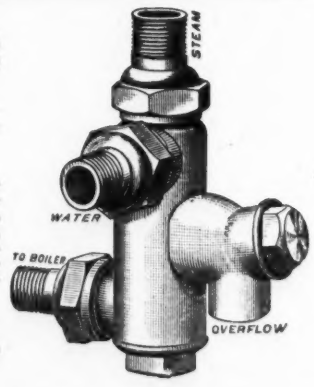

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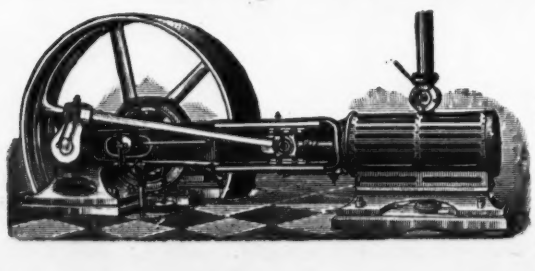

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